69430
S/139/60/000/01/004/041
E072/E334

The Problem of the Role of Closed Pores in Sintering in Powder Metallurgy

formation. Under the microscope it is found that Al particles tend to disappear while the (initially) Ni particles expand (Figure 8 for 30% Al mixture, 8 hours at 620 °C, then heated to 1 250 °C and immediately cooled. x 400). Finally, Figure 9 shows shrinkage as a function of composition for 1, 3 and 5 hours at 1 250 °C following heating for 8 hours at 620 °C. There is a slight expansion for mixtures ~15 - 45% Al. It is emphasized that in sintering a mixture of materials, it is important to outgas at temperatures below the melting point of any constituent. There are 9 figures and 3 Soviet references.

ASSOCIATION: Khar'kovskiy gosuniversitet imeni A.M. Gor'kogo (Khar'kov State University imeni A.M. Gor'kiy)

SUBMITTED: March 11, 1959

Card 4/4

18.6100
18.8200

S/148/60/000/002/005/[illegible]

AUTHORS: Pines, B Ya., Sirenko, A P

TITLE: Diffusion Creep and Non-Equilibrium State in Metal, Ceramic and Cast Metals

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, 1960, Nr 2, pp 81 - 89

TEXT: The following deviations from regularities of [illegible] were observed during investigations into diffusion creep of metal, ceramic [illegible] presence of an unsettled creep stage, non-linear dependence of the creep rate on the magnitude of applied stress, unequal rate and deformation of creep in tension and compression, and reduced values of the activation energy of creep, i.e., self-diffusion. Investigations into diffusion creep of metal, ceramics subjected to pressure were carried out on samples of aluminum, copper with $\leq 50\,\mu$ grain size under a load of 10 g/mm^2 at 1,000°. A high-vacuum device, shown in Figure 1, was used to investigate compression creep. Results of experiments are given in Table 1. It was established that the observed irregularities were caused by the non-equilibrium state of the sample

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Diffusion Creep and Non-Equilibrium State in Metal Ceramics and [illegible] Metals

They can be fully eliminated by sufficiently extended high-temperature annealing. Furthermore, investigations were carried out into creep after hard facing of metal ceramics pressed from iron powder. Results of experiments are given in Table 2. It was established that hard facing speeded-up diffusion creep at high temperatures (e.g. in iron at 900°C) mainly at the unsettled stage. At lower temperatures (700°C for iron) hard facing caused a decrease in the creep rate. This proves that creep at such temperatures has not a purely diffusion but probably a dislocation nature. Results obtained from experiments with Co-Ni, Ni-Fe and Ni-W powders [Ref 6] were analogous to those obtained with other systems including the Cr + Mo systems. Pure component and 50% Cr + Mo powder mixtures were tested at 1,300°C in a vacuum under a load of 75 g/mm^2. The samples were preliminary annealed in a vacuum at 1,300°C and 1,500°C for up to 14 hours. [illegible]des deformation creep, shrinkage in sintering during preliminary a[illegible]ling was studied. Results of experiments are given in Figure 4. It was established that diffusion creep was always accelerated (mainly at the unsettled stage) in samples having excessive vacancies, arising as a result of non-uniform partial heter[illegible] diffusion. In metal ceramic samples of Cr and Mo powder mixtures, the creep

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S/148/60/000/002/005/0[illegible]

Diffusion Creep and Non-Equilibrium State in Metal Ceramics and Cast Me[illegible]

acceleration was correspondingly low at 1,300°C, when heterodiffusion occurred. Annealing at 1,500°C during 50 minutes delayed the creep of pure component samples; on the other hand, the creep of powder mixtures was accelerated After extended annealing (8 hours) creep of powder mixtures was slowed down due to the gradual elimination of excessive vacancies
There are: 1 photograph, 1 diagram, 3 tables, 3 graphs and 6 Soviet references.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet (Khar'kov State University

SUBMITTED: March 19, 1959

Card 3/3

S/148/60/000/005/005/009

AUTHORS: Pines, B.Ya., Sirenko, A.F.

TITLE: "Recovery" Under Load in Processes of Diffusion Creep of Metal Ceramics

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, 1960, Nr 5, pp 121 - 129

TEXT: Diffusion creep in porous metal ceramics was studied by experiments made with specimens pressed from copper powder (electrolytic origin, grain size < 50μ), nickel powder (reduced from carbonyl; grain size 10 - 15μ and tungsten (grain size 5 - 10μ). The experiments are illustrated by a number of graphs. It was established that metal, alloy and, particularly, metal ceramic specimens, subjected to diffusion creep at raised temperatures, revealed considerable retardation of other diffusion processes, such as sintering, recrystallization and heterodiffusion. This retardation was connected with the non-equilibrium state of the specimens and arose in connection with the gradual approach to the equilibrium. Diffusion coefficients decreased correspondingly. Thus, speeded-up "recovery" of equilibrium properties under

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S/148/60/000/005/005/009

"Recovery" Under Load in Processes of Diffusion Creep of Metal Ceramics

load occurred. Retardation of diffusion processes at various temperatures was proportional to the rate of diffusion creep, if applied strain was constant. If at various temperatures "corresponding" strains were applied, which caused the equal rate of creep, the retardation of diffusion processes was the same. The retardation of diffusion processes in diffusion creep did not depend on the sign of the strain applied, and was equal during tension and compression. The first non-steady stage of diffusion creep may be interpreted as corresponding to the decreasing rate of creep proper, resulting from the speeded-up recovery of the regularity of the crystalline lattice and the equivalent values of self-diffusion constants under load.
There are: 10 graphs, 1 set of micro-photometric curves and 6 Soviet references.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet (Khar'kov State University)

SUBMITTED: March 19, 1959

Card 2/2

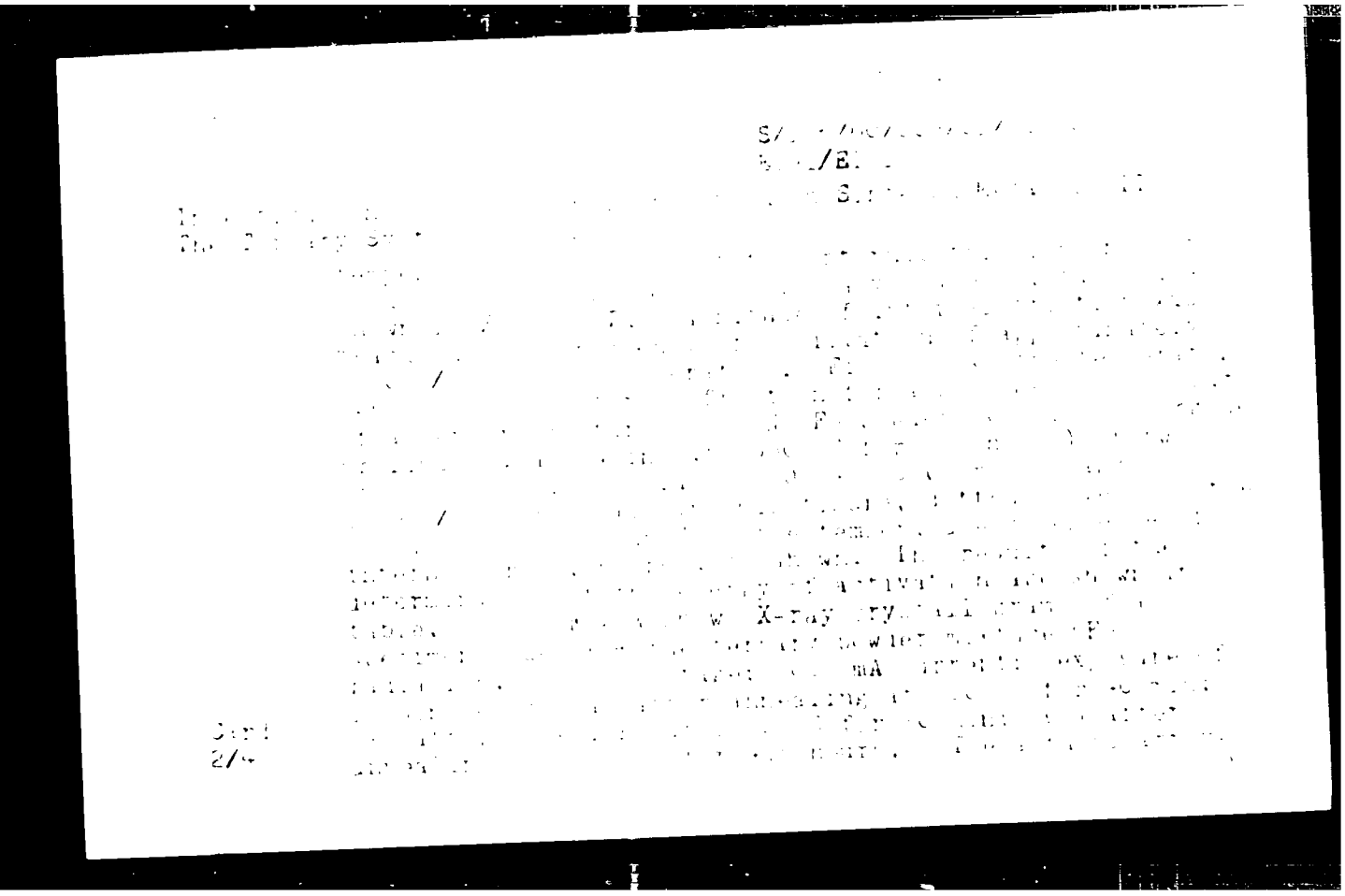
17 6103

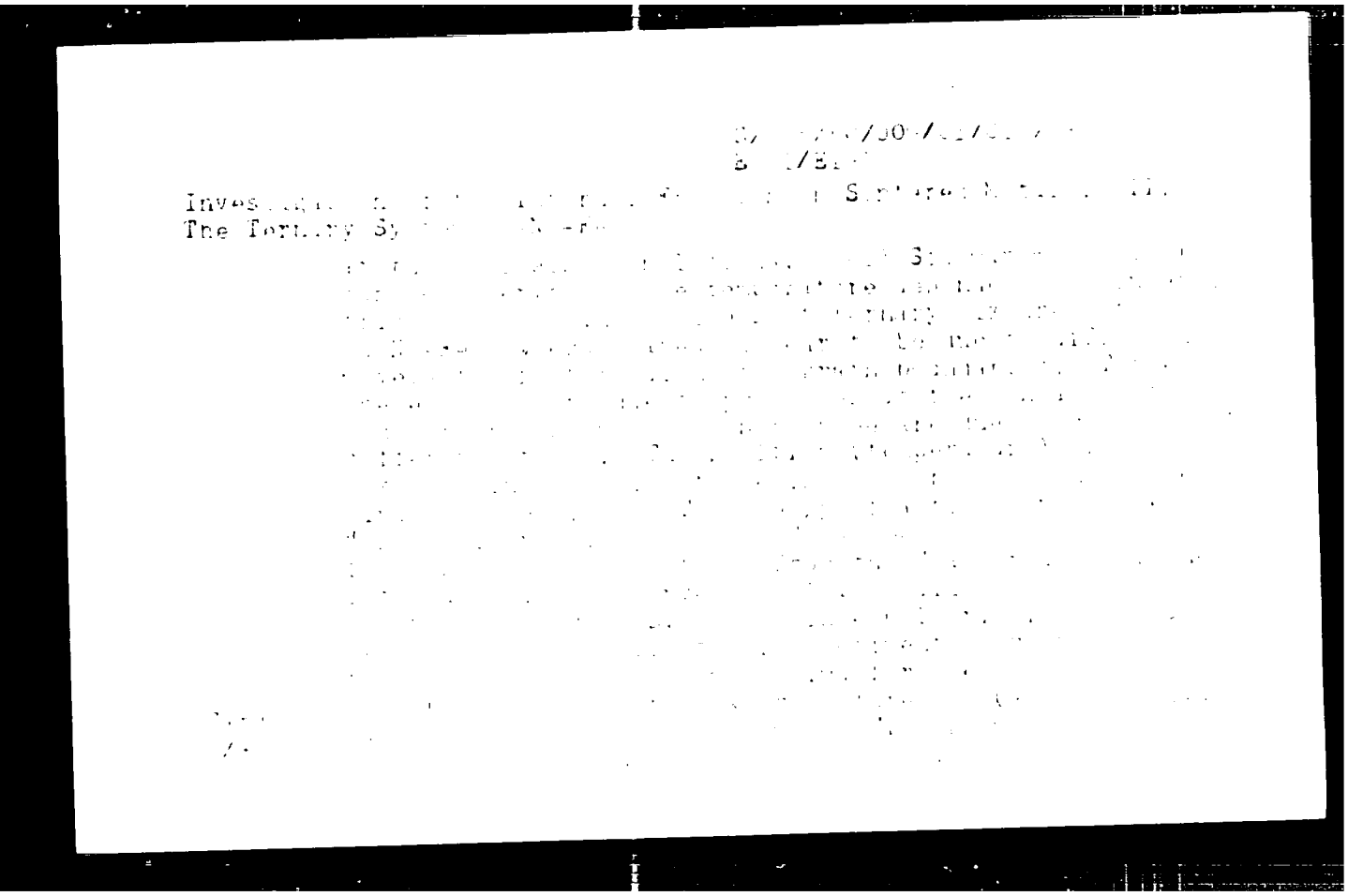
AUTHORS: [illegible]

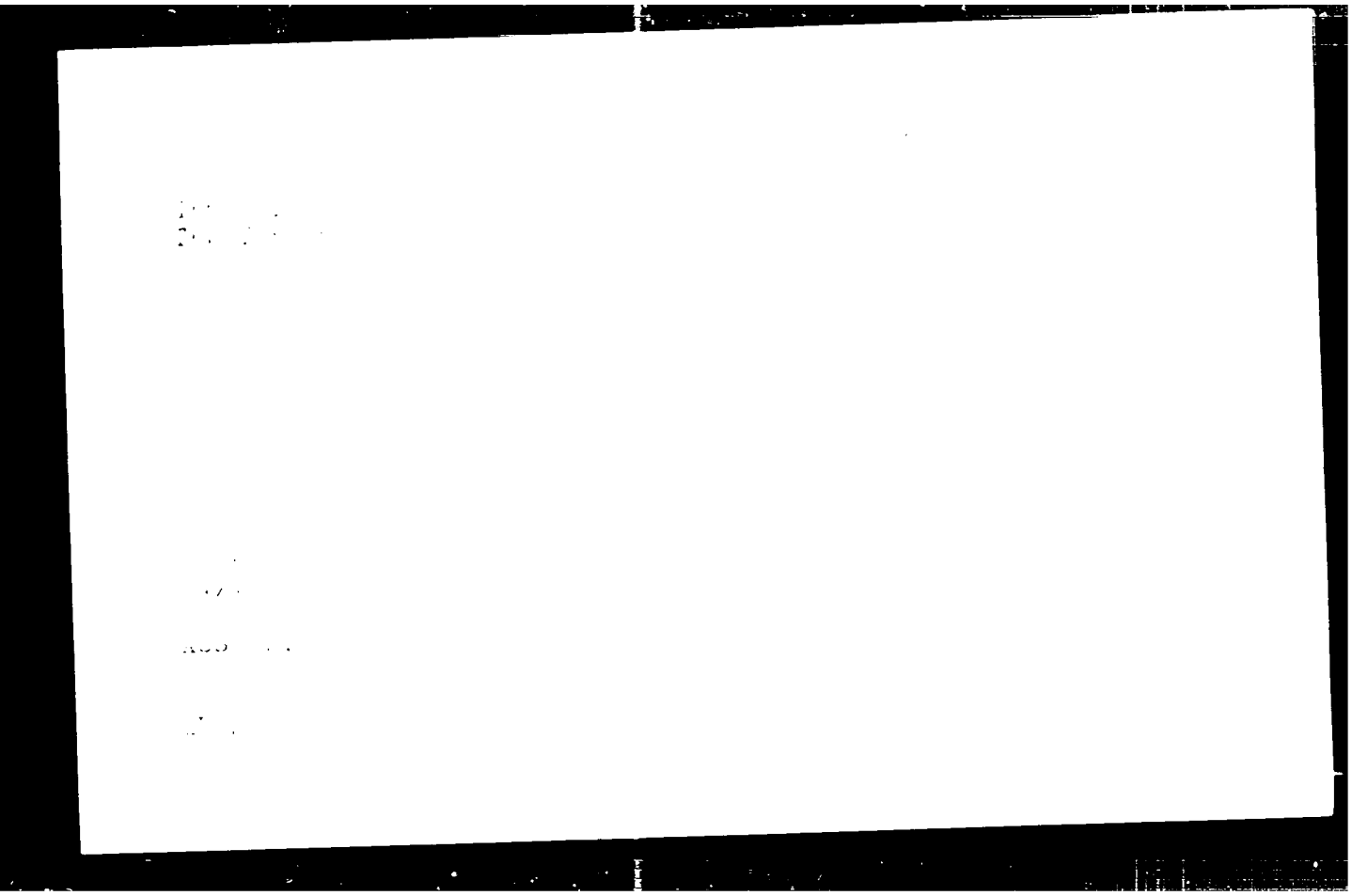
TITLE: [illegible]

PERIODICAL: [illegible]

ABSTRACT: [illegible]







S/[illegible]/[illegible]/[illegible]

E[illegible]/E[illegible]

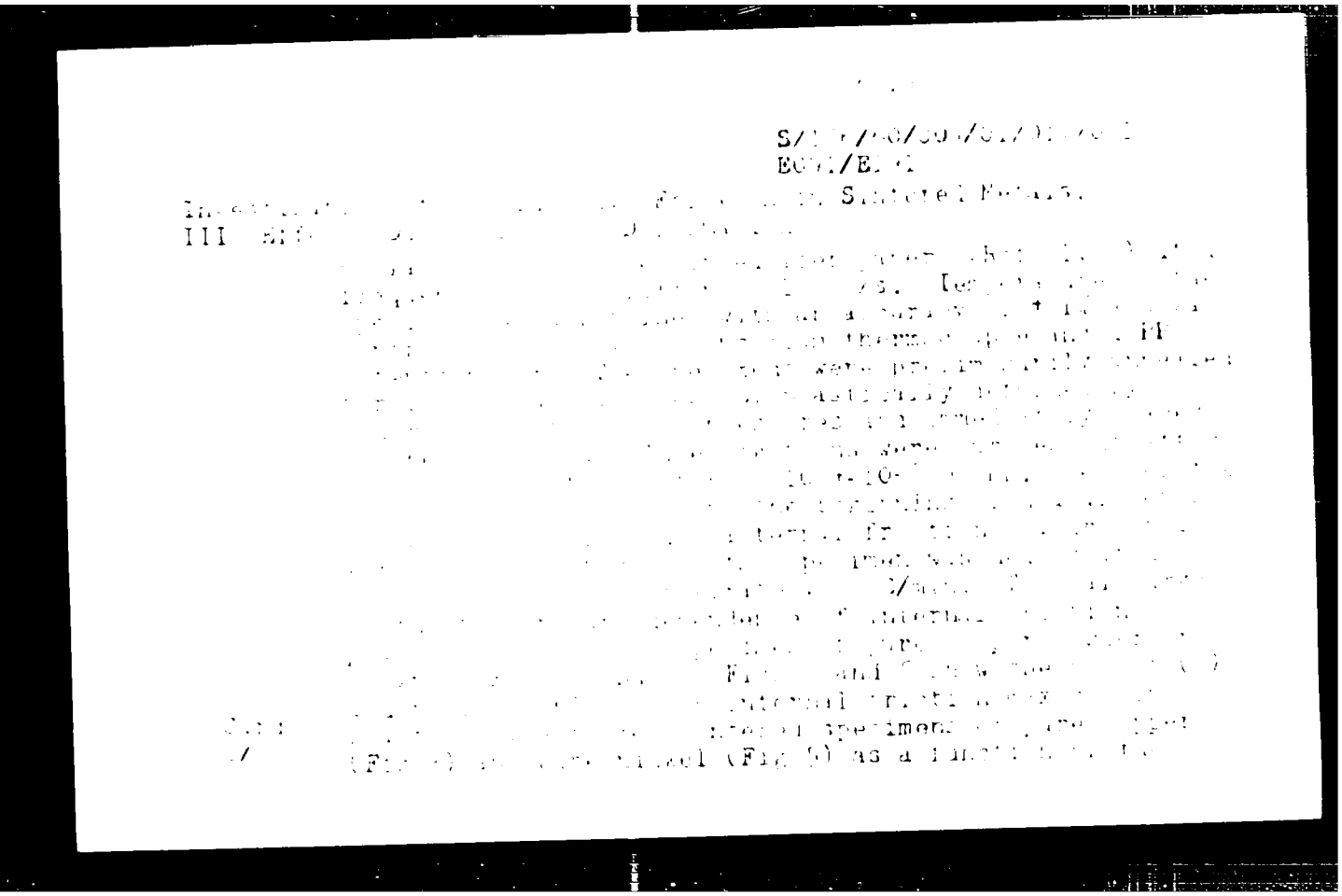
12 6100

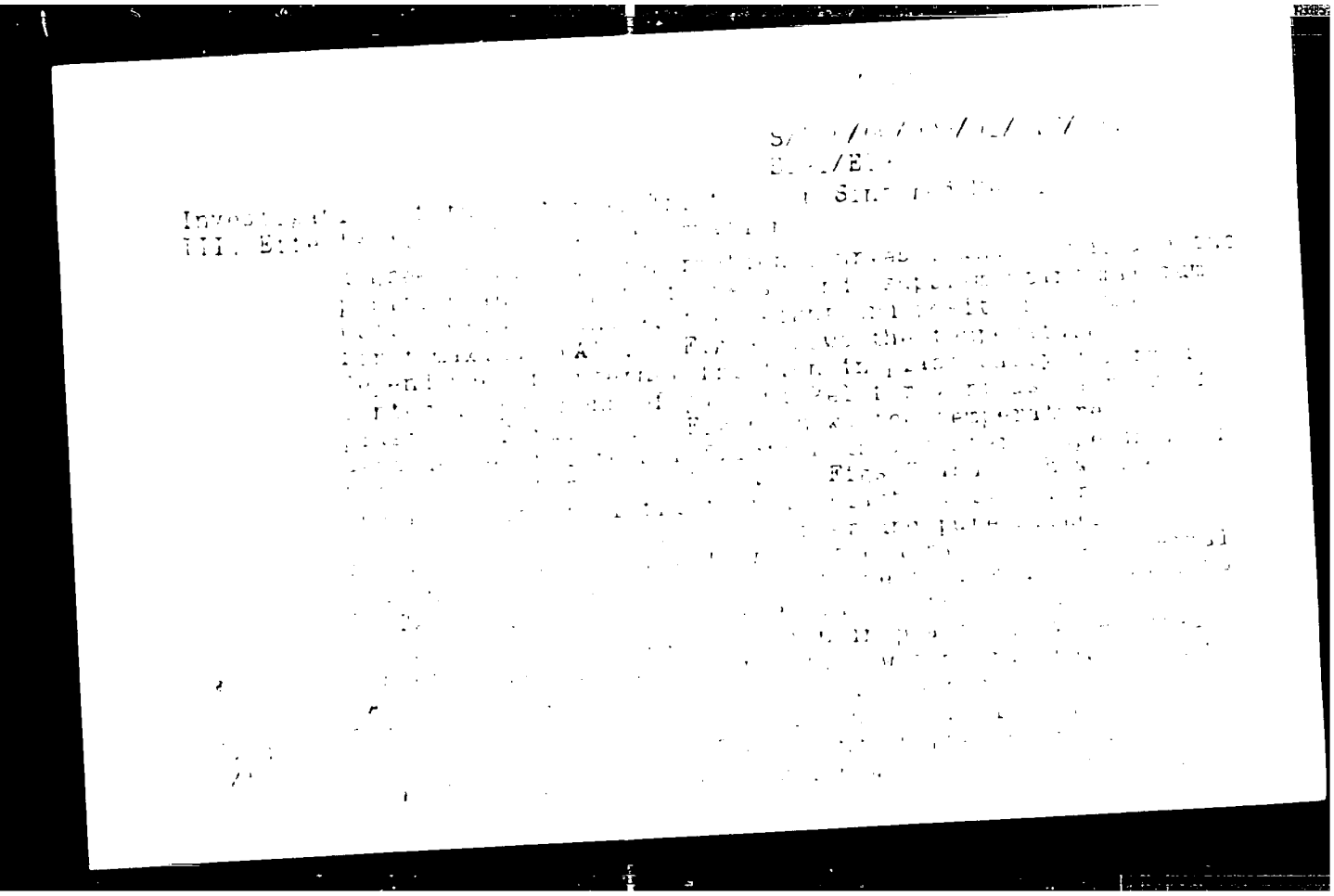
AUTHORS: [illegible]

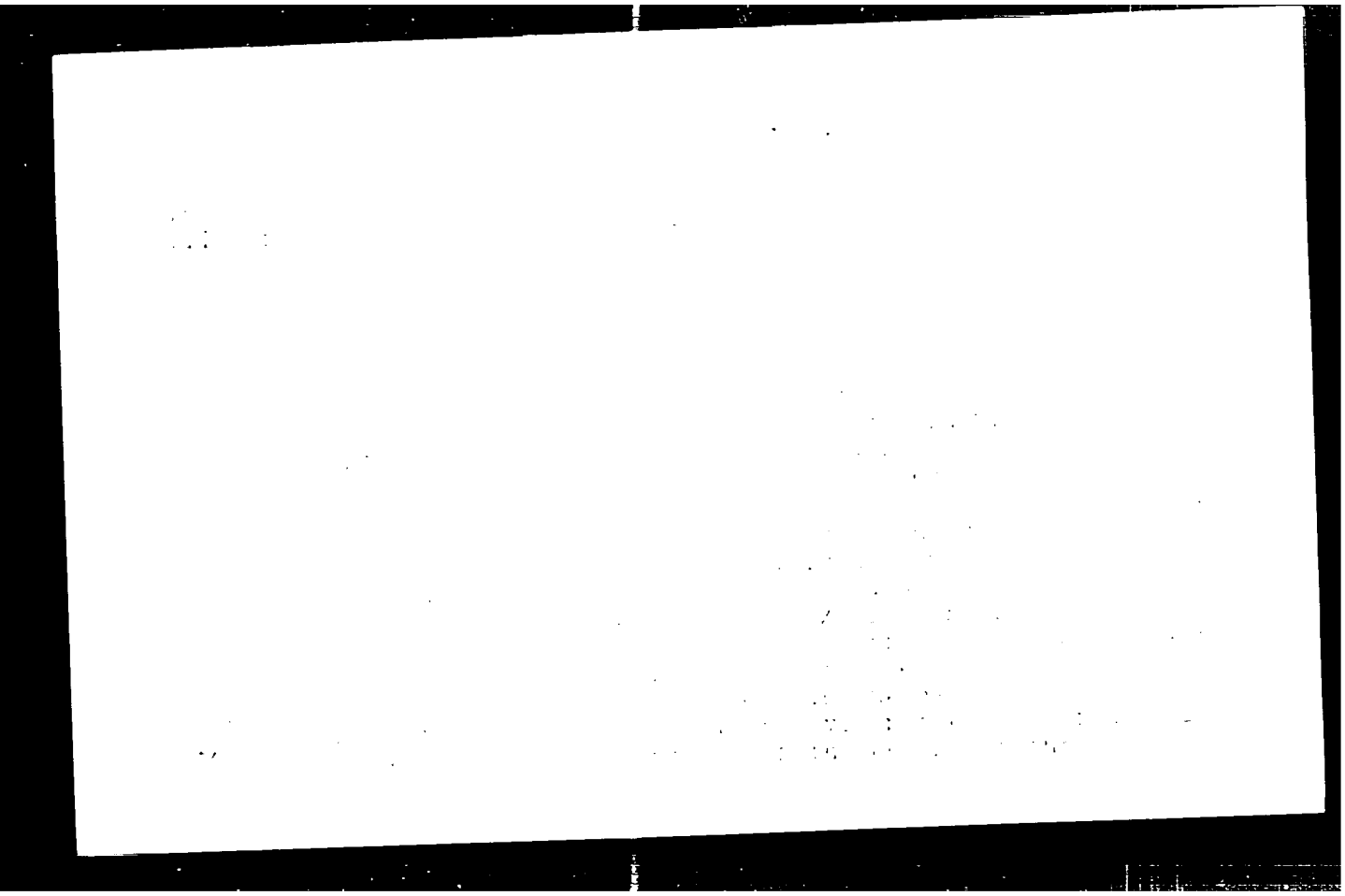
TITLE: [illegible]

PERIODICAL: [illegible]

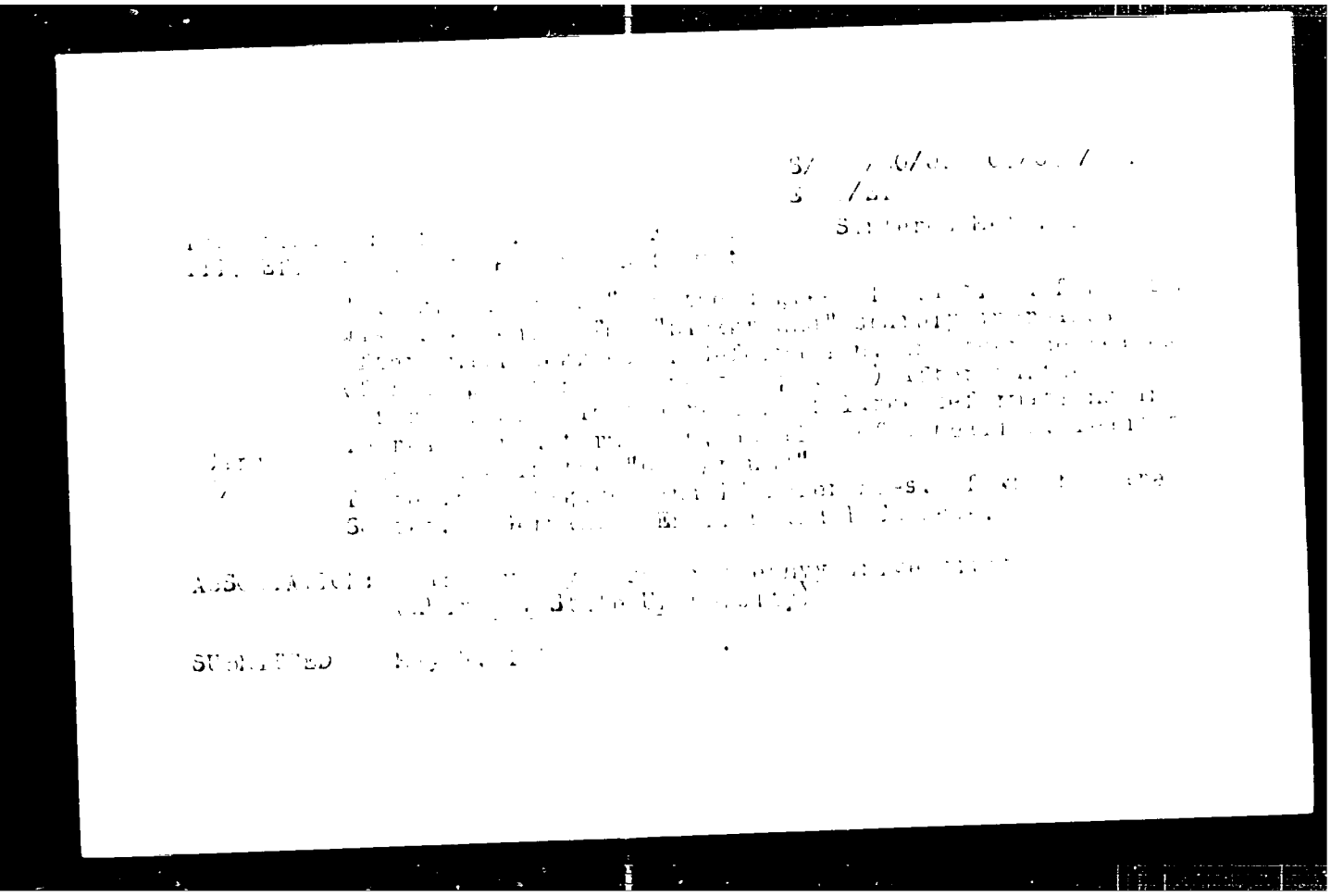
ABSTRACT: [illegible]







APPROVED FOR RELEASE: 06/15/2000 CIA-RDP86-00513R001340920003-9"



S/126/60/009/03/010/033
E091/E435

AUTHORS: Pines, B.Ya. and Chaykovskiy E.F.

TITLE: Influence of Plastic Deformation of Nickel on the Diffusion Rate in the Ni-S System

PERIODICAL: Fizika metallov i metallovedeniye 1960, Vol 9, Nr 3, pp 369-373 (USSR)

ABSTRACT: Specimens of the shape of rectangular blocks, 5 x 5 x 10 mm, were made from technically pure nickel. In order to remove distortions due to mechanical working, the specimens were annealed in a reducing atmosphere of hydrogen at 1000°C for one hour They were then deformed in compression and the degree of deformation δ was determined from the formula

$$\delta = \frac{H - h}{H} \cdot 100\% \qquad (1)$$

where H is the initial thickness of the specimen and h is the final thickness after compression. The maximum degree of deformation was 80%. After deformation, the specimens were subjected to diffusion annealing in sulphur vapours. Several specimens with various degrees

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S/126/60/009/03/010/033
E091/E435

Influence of Plastic Deformation of Nickel on the Diffusion Rate in the Ni-S System

of deformation were annealed simultaneously. In order to determine the diffusion rate of sulphur in nickel the thickness of the layer of Ni-S compounds formed during isothermal annealing was measured by means of a MIM-6 metallurgical microscope or with a micrometer Two methods of annealing were tried, the first as outlined by Presnyakov's paper (Ref 6) and the other by annealing nickel in sulphur vapours The first method proved to be unreliable. The second method, which was adopted by the authors, involved annealing in a special simple vacuum apparatus in which the vapour pressure of S could be fairly accurately attained and controlled independently of the diffusion annealing temperature of the specimen. The apparatus has two nichrome heaters mounted on one vertical porcelain tube. The lower heater volatilizes the S and the upper one is a furnace for diffusion annealing in the middle portion of which the nickel specimens were placed on a holder. Above the second heater is a cooler on which the S

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Influence of Plastic Deformation of Nickel on the Diffusion Rate in the Ni-S System

vapours condense. After each annealing, the S was scraped off the walls of the cooler and thrown into the lower volatilizing furnace. The quantity of S in the volatilizer was chosen so that this element should not be able to volatilize completely during the maximum annealing time. The upper portion of the porcelain tube, through which the ends of the thermocouple were led to a hermetic seal, were connected to the tube for evacuation and pressure control in the apparatus Evacuation by means of a vacuum pump reduced the pressure in the apparatus above the cooler during annealing to approximately 10^{-2} mm Hg. The temperature of the volatilizing furnace was maintained at 300°C which ensured a S vapour pressure in the working space of the furnace of approx 50 mm Hg (Ref 7): the temperatures of the volatilizing furnace and the diffusion annealing furnace were controlled by two nickel-nichrome thermocouples. The lay-out of the apparatus is shown in Fig 1. Diffusion annealing was carried out at 440°C

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S/126/60/009/03/010/033
E091/E435

Influence of Plastic Deformation of Nickel on the Diffusion Rate in the Ni-S System

for one hour, at 500°C for one hour and at 600°C for 15 and 30 minutes. Control runs were carried out at an annealing temperature of 700°C. The results are shown in Fig 2. The dependence of the thickness of the Ni-S compound layer on the degree of deformation δ, which can be found experimentally, enables the change of the diffusion coefficients D of S through this layer with increase in δ to be determined. For the evaluation of D, Pines' ratio $D = \ell^2/4t$ was used (Ref 5), where ℓ = thickness of the phase layer forming as the result of uniform diffusion, t = time of isothermal annealing. In Fig 3, the values of diffusion coefficients thus found in relation to degree of preliminary deformation are shown for Ni specimens annealed in S vapours at 600°C for 30 minutes. From the values of D found, the activation energy of diffusion of S vapours through the layer of nickel sulphides formed were determined from the relationship

Card 4/5 $\log D - \frac{1}{T}$. There are 3 figures and 9 references, ✓

IP 6200

80085
S/020/60/131/06 23 CP
B014/B007

AUTHORS: Pines, B. Ya., Sirenko, A. F.

TITLE: The Problem Concerning the Conditions of Reversibility of the Destruction Processes of Metals Under Load

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 131, No. 6, pp. 1312 - [illegible]

TEXT: The experiments described were made with powder-metallurgical samples which were pressed from electrolytic copper. The samples had an initial porosity of 17 - 18%, which was reduced to 3 - 4% by sintering at 1050°C (for 24 hours). The life of a series of 35 equal samples was determined after applying the same load in each case. From these values the average life was determined. The life of a further series of 35 samples under load was determined after intermediate annealing. Also in this case the average life was determined. In Fig. 1 the results of life determination at room temperature without intermediate annealing and of life in the case of intermediate annealing at 600°, 900°, and 1040°C are graphically represented. In Fig. 2 the analogous results of durability determination under stress at 600°C are shown. It is found that intermediate annealing for four hours at 1040°C produces the same results as intermediate annealing for ten

Card 1/2

hours at 900°C; for a complete healing of defects, annealing for 35 hours at 1040°C is necessary. Fig. 3 graphically represents the dependence of the quantity $\Delta\tau = \overline{\tau_1 + \tau_2} - \bar{\tau}$ on the time t (τ_1 and τ_2 are the life before and after intermediate annealing, $\bar{\tau}$ is the mean life without intermediate annealing). Herefrom, conclusions are drawn as to the diffusion-character of healing. By extrapolation of the straight lines obtained from the experimental data, the annealing time necessary for complete healing of the defects is determined as being 105 hours at 600°C, and as being 16 hours at 1040°C. The ratio between these two times is about 7.2 and corresponds to the ratio between the coefficients of the self-diffusion of copper at these two temperatures. Thus, all arguments indicating the diffusion-character of the growth of cracks after stresses are strengthened. There are 3 figures and 5 references, 4 of which are Soviet.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A. M. Gor'kogo (Khar'kov State University imeni A. M. Gor'kiy)

PRESENTED: January 15, 1960, by G. V. Kurdyumov, Academician

SUBMITTED: December 12, 1959

Card 2/2

ACC NR: AP7005239 SOURCE CO.: [illegible]/0635

AUTHOR: Pines, B. Ya.; Karmazin, A. A.

ORG: Khar'kov State University (Khar'kovskiy gosuniversitet)

TITLE: Concerning the activation energy of the temperature background of internal friction

SOURCE: Fizika metallov i metallovedeniye, v. 22, no. 4, 1966, 632-635

TOPIC TAGS: activation energy, internal friction, temperature dependence, crystal dislocation, impurity level

ABSTRACT: Two standard equations were given for temperature dependent internal friction: $Q^{-1} = A \exp(-U/kT)$ $Q^{-1} = \frac{A_1}{T} \exp(-U/kT)$.

In these equations it was noted that the activation energy of background internal friction (U) was very different from the activation energy of the grain boundary peak (U_1). For example, in Cu the value of U_1 is 48 kcal/mol, while U is only 8-10 kcal/mol. No internal friction mechanism could be related easily to such low values of U. Therefore a new equation was presented: $Q^{-1} = K[\omega \exp(U_0/kT)]^{-n}$.

UDC: 539.67

Card 1/2

ACC NR: AP7005139

where K and n are constants in a particular temperature range, U_0 is the activation energy for viscous dislocation flow, and ω is the oscillation frequency. The value of n could be obtained from the frequency dependence of Q^{-1}, and was related to U by $U = nU_0$. Values of U, n, U_0, and activation energies for self diffusion were tabulated for ten different pure metals, in various temperature and frequency ranges. In every case, U_0 was equivalent to the activation energy of self diffusion. Values of n ranged from 0.17 to 0.38. The experiments quoted were done on vacuum pendulums of the Ke type at frequencies ranging from 0.25 to 3.3 cps and amplitudes below $2 \cdot 10^{-5}$. Data were also given on the effects of linear and point defects in pure alunimum. Dislocation densities were varied by cold working different amounts and Fe, Si, and Cu additions were made up to 0.3%. Values of U ranged from 4.0 to 11.0 kcal/mol; however, U_0 did not vary by more than 10% from the 99.9998% aluminum value of 36 kcal/mol. From a phenomenological point of view the new equation for Q^{-1} was related to a broad spectrum of relaxation times $\tau = \tau_0 \exp(U_0/kT)$, where U_0 is constant; that is

$$Q^{-1} = A_1 \int_0^{\infty} \frac{\omega\tau}{1 + \omega^2\tau^2} dz.$$

where dz is the number of values of τ_0 in the interval $d\tau_0$. Orig. art. has: 2 tables, 6 formulas.

SUB CODE: 11,20/ SUBM DATE: 18Jan66/ ORIG REF: 003/ OTH REF: 002

Card 2/2

ACC NR: AP[illegible] SOURCE CODE: [illegible]

AUTHOR: [illegible], B. Ya.; Bazyura, R. I.; [illegible]v, V. P.

ORG: Kh[illegible] State University [illegible] A. M. [illegible] (Khar'kov [illegible])

TITLE: [illegible]

SOURCE: [illegible] metallov i metallovedeniye, v. [illegible], no. [illegible], 1967, 179-18[illegible]

TOPIC TAGS: [illegible] copper, nickel, creep mechanism

ABSTRACT: [illegible] studies [illegible] the kinetic [illegible] temperature creep [illegible] B. Ya., et al. [illegible], 2-59; P[illegible], [illegible] Ya., Khizhkovyy, V. P. [illegible] established [illegible] rate [illegible] steady-state cre[illegible] stress [illegible] > 0.5 T[illegible] values of [illegible] creep rate [illegible] increases with [illegible]. Once p exceeds a certain critical limit (the so-[illegible] p_0 of [illegible] creep rate begins to sharply increase. It was found that p is proportional [illegible] elasticity. Now the authors investigate the effect of soluble impurities on the [illegible] temperature dependence of p_0 with respect to alloys of the Cu-Ni system forming a [illegible] series of solid solutions (Cu + 5, 10, 15, 30, 40, 70, and 90% Ni). Findings: p_0 and the modu-

Card 1/2

UDC: 669.3:539.5

ACC NR: AP7005763

lus E of elasticity increase with increase in the N. concentration of the alloy. [illegible] p_0 (i.e. the limit of linear increase in creep) linearly decreases with increase in [illegible] and reaches 0 when $T = T_{m.p.}$ Nevertheless, p_0 cannot be regarded as an analog of yield point at high temperatures at which diffusion creep occurs, because the values of [illegible] in cold-worked metals and alloys are lower than in specimens annealed at high temperatures. At medium temperatures preliminary cold working causes hardening of the metal and retardation of creep rate, whereas at temperatures close to the melting point preliminary cold working leads to "softening" of the metal and increase in creep rate. There is as yet no unambiguous explanation for this phenomenon. It may be associated with the enhanced (above equilibrium) concentration of vacancies occurring in the presence of a large number of dislocations which results in an accelerated climb of dislocations." The authors are grateful to S. S. Avotin for participation in preparing specimens of the alloys." Orig. art. has: 4 figures.

SUB CODE: [illegible] 20/ SUBM DATE: 31May66/ ORIG REF: 006/ OTH REF: 007

Card 2/2

S/0137/64/000/001/0036/0036

ACCESSION NR: AR4018311

SOURCE: RZh. Metallurgiya, Abs. 1G246

AUTHOR: Pines, B. Ya.

TITLE: Some aspects of the theory of sintering of metal powders

CITED SOURCE: Tr. Kuyby*shevsk. aviats. in-t, vy*p. 16, 1963, 131-133

TOPIC TAGS: metal powder sintering, powder sintering theory

TRANSLATION: The basic process in sintering is volume diffusion of matter under the influence of capillary forces. Frenkel's theory, which treats sintering as [illegible] the viscous flow of matter under the influence of capillary forces, is [illegible] theory. In this theory, the viscosity coefficient is determined [illegible] of self-diffusion. The discrepancy between shrinkage value [illegible] theory and those observed experimentally is due to the presence [illegible] defects. Knowledge of this relationship is necessary for the development [illegible] theory of sintering and theory of creep of compact materials [illegible] forces. In the case of sintering, the problem is complicated by the fact that the state of the crystal lattice and the character of its defects change substantially

Card 1/2

ACCESSION NR: AR4018311

in the course of sintering. Dislocations and vacancies have different effects on the magnitude of the diffusion coefficient. O. Padalko

SUB CODE: MM ENCL: 00

Card 2/2

PINES, A.I., prof.

"Therapeutic use of amino acids in neuropsychic diseases" by A.L. Andreev. Reviewed by A.I. Pines. Sov. med. 22 no.12:136 D '58. (MIRA 12:1)
(AMINO ACIDS) (NERVOUS SYSTEM--DISEASES)
(ANDREEV, A.L.)

L 45457-65 EWT(1)/EWT(m)/EPF(n)-2/T/EWP(b)/EED(b)-3 Pae-2/Pu-4 LJP(c)
ACCESSION NR: AP5007056 JD/JG S/0120/65/000/001/0192/0194

AUTHOR: Pines, B. Ya.; Kovalenko, S. I.

TITLE: Multiframe high-temperature electron-diffraction camera

SOURCE: Pribory i tekhnika eksperimenta, no. 1, 1965, 192-194

TOPIC TAGS: electron diffraction camera

ABSTRACT: A new photoplate magazine capable of producing 24 pictures (on four 9 x 12-cm plates) without reloading is described. The new electron-diffraction camera is equipped with three specimen holders (independent specimen heating) which can be successively introduced into the electron beam. The specimens are fastened to tantalum strips which carry the controllable heating current. Also, transillumination of film-type specimens is provided for. Sketches of the camera and specimen holder are supplied. Orig. art. has: 3 figures.

ASSOCIATION: Khar'kovskiy universitet (Khar'kov University)

SUBMITTED: 28Dec63 ENCL: 00 SUB CODE: NP, ES

NO REF SOV: 003 OTHER: 002

Card 1/1

L 51409-65 EWT(m)/EWP(i)/T/EWP(t)/EWP(z)/EWP(b) Pad IJP(c) JD/HW
ACCESSION NR: AP5010694 UR/0181/65/007/004/0961/0965

AUTHOR: Pines, B. Ya., Kuznetsova, R. I.

TITLE: Concerning the absolute value of the submicroporosity that develops in electrolytic films of metals after annealing and under load

SOURCE: Fizika tverdogo tela, v. 7, no. 4, 1965, 961-965

TOPIC TAGS: porosity, metal film, annealing, copper, nickel, iron

ABSTRACT: The absolute values of the number N_i and volume V_i of pores of different sizes, and of the total submicroporosity V, is determined on the basis of small-angle x-ray scattering data obtained by the authors earlier (FTT v. 3, 1475, 1961; v. 4, 1247 and 3409, 1962). The material tested comprised electrolytic films of copper, nickel, and iron, as well as compound copper-nickel films, annealed at different temperatures both under the influence of tensile stress and without such a stress. The earlier investigations yielded only the relative values of these quantities. The absolute intensity of the incident radiation was determined by measuring the intensity of the primary beam attenuated by passage through specially

Card 1/2

L 51409-65

ACCESSION NR: AP5010694

chosen absorbers. The results are tabulated. It is concluded that the small-angle scattering method does not yield the total volume of the pores present in the body, although the variation of density with annealing temperature, both with and without load, is qualitatively in agreement with the results of this method. Orig. art. has: 10 formulas and 1 table.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A. M. Gor'kogo (Khar'kov State University)

SUBMITTED: 18Jun64 ENCL: 00 SUB CODE: SS, MM

NR REF SOV: 006 OTHER: 002

Card 2/2

L 43901-65 EEC(b)-2/EWP(z)/EWA(c)/EWT(1)/EWT(m)/EWP(b)/T/EWA(d)/EWP(t) Pi-4
IJP(c) GG/JD

ACCESSION NR: AP5006867 S/0181/65/007/003/0687/0694

AUTHOR: Pines, B. Ya.; Sirenko, A. F. 38 36 B

TITLE: Formation of diffusion porosity in self diffusion

SOURCE: Fizika tverdogo tela, v. 7, no. 3, 1965, 687-694

TOPIC TAGS: diffusion porosity, self diffusion, vacancy motion, dislocation motion, pore formation, crystal lattice distortion

ABSTRACT: To determine the conditions under which diffusion porosity appears via self diffusion, and the laws governing its development, several experiments were carried out in bodies made up of parts of the same material (copper) but of different structure (cast, highly annealed, deformed [cold hardened], and metal-ceramic). The tests have shown that heating a composite body consisting of atoms of one kind but containing parts with different degrees of crystal-lattice distortion leads to the occurrence of diffusion porosity in that part of the body where the lattice distortions are smaller. The presence of porosity in parts of the body having larger distortion (larger dislocation density) does not hinder the development of diffusion porosity in the part closer to thermodynamic equilibrium,

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L 43901-65

ACCESSION NR: AP5006867

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even when pores of smaller radius than in the distorted section are obtained in the section closer to the equilibrium. These pores no longer serve as sinks for vacancies. If closed pores filled with gas are present in the distorted part of the body, this part does not shrink upon heating, but grows (under the influence of the gas pressure), i.e., the pores become sinks for vacancies and the formation of diffusion porosity in the neighboring less distorted regions of the body greatly decreases, or may stop completely. "Student P. A. Flomina participated in the experimental part of the work." Orig. art. has: 6 figures, 3 formulas, and 1 table.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A. M. Gor'kogo (Khar'kov State University)

SUBMITTED: 16Jun64 ENCL: 00 SUB CODE: MP, SS

NR REF SOV: 007 OTHER: 002

Card 2/2 mb

L 34896-65 EWT(l)/EWT(m)/EWP(w)/EWA(d)/EEC(t)/T/EWP(t)/EWP(k)/EWP(b)/EWA(c)
Pf-4/Pad/Peb LJP(c) JD/HW
ACCESSION NR: AP5005266 S/0181/65/007/002/0351/0354

37
36
B

AUTHOR: Pines, B. Ya.; Gumen, N. M.

TITLE: Thermomechanical working of cobalt ferrite

SOURCE: Fizika tverdogo tela, v. 7, no. 2, 1965, 351-354

TOPIC TAGS: thermomechanical working, thermomagnetic working, cobalt ferrite, magnetic structure, magnetostriction

ABSTRACT: Thermomechanical working is defined as annealing at a temperature below the Curie point, with simultaneous application of a unilateral elastic compression or tension in the absence of a magnetic field. This is claimed to be the first investigation of the influence of thermomechanical working on magnetic properties of ferrites, and the research was undertaken with an aim at comparing the results with the changes that occur in a ferrite subjected to thermomagnetic working, reported by the authors earlier (Kristallografiya, v. 6, 901, 1961). The ferrite investigated was of the cobalt type with large saturation magnetostriction (-187×10^{-6}). Polycrystalline samples were made from powdered cobalt oxide and iron oxide using the same technology as in the earlier investigation. The thermo-

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L 34896-65

ACCESSION NR: AP5005266

mechanical working was via annealing (in a furnace with fifilar heating coil) samples exposed to compression up to 5 kg/mm^2, in a cycle consisting of rapid heating, soaking for three hours without load, soaking for five hours under load, and rapid cooling to room temperature. The annealing temperatures were 300, 400, and 450C. The results show that different working temperatures correspond to different degrees of uniaxial magnetic texture. The experiments have shown that following the thermomechanical working the dependence of the magnetostriction on the magnetic field is nonmonotonic. No regular connection could be established between the additional volume striction and the load. Measurement of the elastic constants of the ferrite after the thermomechanical treatment exhibited some differences between ferrites subjected to thermomechanical and to thermomagnetic treatment, and it is concluded that the detailed mechanism of establishment of the magnetically uniaxial texture is different in the two processes, although the end result (residual deformation of the crystal lattice) is the same in both cases. Orig. art. has: 2 figures.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet (Khar'kov State University)

SUBMITTED: 20Apr64 ENCL: 00 SUB CODE: SS, EM

NR REF SOV: 005 OTHER: 001

Card 2/2

L 18052-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD

ACCESSION NR: AP3000101 S/0126/63/015/004/0584/0591

57
56

AUTHORS: Pines, B. Ya.; Sirenko, A. F.

TITLE: Speed of the diffusive creep in metals at submelting temperatures

SOURCE: Fizika metallov i metallovedeniye, vol. 15, no. 4, 1963, 584-591

TOPIC TAGS: creep in metal , creep in copper, velocity of creep

ABSTRACT: According to the existing postulates, the diffusive creep in the homogeneously stressed bodies is caused by the existence of atomic sources and voids inside and at the periphery of the body. The formulas expressing the speed of a steady diffusive creep derived by C. J. Herring, I. M. Lifshits, J. Harper, L. Shepard, and J. Dorn are compared; the theoretical and experimental data concerning the effect of the specimen substructure on the creep velocity are discussed. The experiment involved the study of the creep velocity variation (under tension) in 13 electrolytic copper samples. The samples, differing in grain sizes, were subjected to various treatments before experiment. The creep velocity measurements in all the samples were made at the same temperature (1040C) and load ($p=25 g/mm^2$). The experimental conditions corresponded to the diffusive

Card 1/2

L 18052-63
ACCESSION NR: AP3000101

creep the velocity of which depends on the applied stress p. The creep velocity variation observed in these specimens was in the interval from 5.6×10^{-5} 1/sec to 3×10^{-8} 1/sec. The authors conclude that the difference in the speed of a steady creep at the temperature 104°C may amount to more than 3 orders of magnitude and that this speed varies on the structural and substructural state of the specimen, determined by the kind of the preliminary treatment. However, neither of the assumed substructure types, which determine the distance between the atomic sources and voids, can explain the broad range of velocity variations. Possibly the effects obtained experimentally were caused by the superposition of various substructure types. Orig. art. has: 4 formulas, 1 table, and 6 figures.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A. M. Gor'kogo (Khar'kov State University)

SUBMITTED: 03Sep62 DATE ACQ: 12Jun63 ENCL: 00

SUB CODE: ML NO REF SOV: 007 OTHER: 002

Card 2/2

L 11419-63 EWP(q)/EWT(m)/EDS AFFTC/ASD JD
S/032/63/029/005/011/022

55

AUTHORS: Pines, B. Ya. and Ivanov, I. G.

TITLE: Preparing monocrystals of Ni, Cu and Cu-Ni alloys in a vacuum smelting furnace

PERIODICAL: Zavodskaya laboratoriya, v. 29, no. 5, 1963, 588-589

TEXT: A simple method of forming monocrystals of difficultly-fusible metals, nickel, copper and nickel-copper alloys directly from fusions has been worked out. The molten alloy, in a crucible, is driven up into a zirconium test tube by nitrogen at a pressure of 1 atmosphere. The temperature is lowered to several degrees below the solidification point of the alloy and kept there under vacuum for 1 hour. Then it is slowly cooled. Monocrystals up to 100 mm in length and 3-5 mm in diam. have been obtained. There are 2 figures.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A. M. Gor'kogo (Khar'kov State University imeni A. M. Gor'kiy)

ja/CR
Card 1/1

PINES, B.Ya.; SIRENKO, A.F.

Regularities of the creep kinetics of metals at high temperatures.
Fiz.tver.tela 4 no.10:2727-2732 O '62. (MIRA 15:12)

1. Khar'kovskiy gosudarstvennyy universitet imeni A.M.Gor'kogo.
(Creep of metals)

PINES, B.Ya.; SIRENKO, A.F.

Mechanical properties at high temperatures in equilibrium and nonequilibrium states. Fiz.met.i metalloved. 14 no.5:693-700 N '62. (MIRA 15:12)

1. Khar'kovskiy gosudarstvennyy universitet im. A.M.Gor'kogo.
(Metals at high temperatures)
(Phase rule and equilibrium)

L 5475

S/070/63/008/001/003/024
E132/E460

AUTHORS: Pines, B.Ya., Grebennik, I.P.

TITLE: Electron diffraction investigation of heterodiffusion in the system Ge-Si

PERIODICAL: Kristallografiya, v.8, no.1, 1963, 16-20

TEXT: An estimate has been made of the coefficient of heterodiffusion between very thin layers of Ge and Si at 840°C. This is not significantly different from the value found by D.A.Petrov, Yu.N.Shashkov, and I.P.Akimchenko (Collection: Voprosy metallurgii i fiziki poluprovodnikov (Problems of Metallurgy and Physics of Semiconductors) izd-vo AN SSSR, 1957, 130-132) for massive specimens. It is often asserted that the diffusion coefficients when layers of only 100 to 1000 atoms thickness are involved differ from the bulk values. The length of time required to equalize the concentration of Ge and Si throughout a thin layer gives a measure of the diffusion coefficient. This process could be followed by electron diffraction as a double layer was annealed in the camera itself. Ge was deposited on a substrate at 400°C and a layer of Si was evaporated on top at room temperature. The Ge layer was crystalline and gave sharp spots and the Si layer was

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amorphous. At 450-500°C the process of equalization of the concentration had not yet begun. At 800°C the Si crystallized and at 840°C the system became single-phased. From the time required for this process and the thickness of the film, the diffusion coefficient could be estimated as 3×10^{-14} cm^2/sec from the equation $x^2 = Dt$, where x is the thickness and t the time; t was about 120 sec at 840°C and became too short to measure at higher temperatures; x was about 10^{-6} cm. There are 3 figures.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A.M.Gor'kogo (Khar'kov State University imeni A.M.Gor'kiy)

SUBMITTED: June 16, 1962

Card 2/2

S/181/62/004/010/012/063
B108/B104

AUTHORS: Pines, B. Ya., and Sirenko, A. F.

TITLE: The kinetics of the creep of metals of high temperatures

PERIODICAL: Fizika tverdogo tela, v. 4, no. 10, 1962, 2727 - 2732

TEXT: The laws governing the creep of metals were studied on specimens of electrolytic copper, previously rolled and annealed for 20 hrs at 1050°C. The change in load necessary to maintain a constant creep rate over a wide temperature range was checked in order to verify the formula

$$V = Kp^n \exp(-\alpha/RT)$$

(J. Dorn. J. of Mechanics and Physics of Solids, 3, 85, 1954), where V is the creep rate, p is the load, α is the activation energy. The experimental results obtained with an arrangement described in FMM, 7, 766, 1959 showed this formula to be correct. The exponent n decreases with increasing temperature down to n = 1 at about 950°C. There are 5 figures.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A. M. Gor'kogo (Khar'kov State University imeni A. M. Gor'kiy)

Card 1/2

The kinetics of the...

S/181/62/004/010/012/063
B108/B104

SUBMITTED: May 7, 1962

Card 2/2

S/181/62/004/012/008/052
B104/B102

AUTHORS: Pines, B. Ya., Kuznetsova, R. I., and Dubovik, M. F.

TITLE: Development of submicroporosity in composite electrolytic films of the Cu - Ni system during heating and loading

PERIODICAL: Fizika tverdogo tela, v. 4, no. 12, 1962, 3409-3414

TEXT: The scattering of X-rays at small angles and the kinetics of the destruction of thin electrolytic films of pure metals (Cu, Ni, Fe) were investigated in continuation of previous studies (B. Ya. Pines, R. I. Kuznetsova, FTT, 3, 1475, 1951; 4, no. 5, 1962). The change of submicroporosity in Cu-Ni films during annealing at different temperatures without and with load (230 G/mm^2) was studied by means of X-ray scattering. A copper film was electrolytically deposited on a polished steel plate, then separated from the plate, annealed and electrolytically coated on both sides with nickel. The total thickness of specimen 1 (17μ) was composed of 85% Cu film and 15% Ni films, and that of specimen 2 of 50% Cu film. Results: a maximum volume of pores was found in the films, exceeding that of single component films by one order of magnitude. This

Card 1/2

is explained by additional formation of pores through nonuniform partial heterodiffusion (Frenkel' effect of first kind). Under annealing at 1100°C, submicroporosity in the unloaded state increases at first, passes through a maximum and then drops. Annealing under load always leads to an increase in submicroporosity; the higher the annealing temperature, the bigger the increase. The development of submicroporosity in consequence of heterodiffusion leads to a noticeable reduction of the heat resistance offered by the composite Cu-Ni films. The amount of this reduction is determined not only by the total volume of the pores but also by their distribution in the film. There are 3 figures and 1 table.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A.M. Gor'kogo (Khar'kov State University imeni A. M. Gor'kiy)

SUBMITTED: July 2, 1962

S/126/62/014/005/007/
E193/E383

AUTHORS: Fines, B.Ya. and Sirenko, A.F.

TITLE: On the problem of high-temperature mechanical properties of metal specimens in the equilibrium and non-equilibrium condition

PERIODICAL: Fizika metallov i metallovedeniye, v. 14, no. 5, 1962, 693 - 699

TEXT: The rate of diffusion processes, which play an important part in the deformation of metals at elevated temperatures, depends on whether or not the metal is in a state of equilibrium. This can be explained in terms of a hypothesis that the process of "healing" of defects in a distorted crystal lattice is accompanied by the formation of a considerable number of excess vacancies accelerating all the diffusion processes. The object of the present investigation was to check the validity of this hypothesis by obtaining more detailed, systematic data on the effect of work-hardening and annealing on the mechanical properties of metals at elevated temperatures. Creep tests were conducted on Ni, Fe and Al specimens in both cold-worked (20-70 reduction in thickness) and annealed

Card 1/3

conditions. [illegible] test temperature [illegible] from [illegible] Ni, from [illegible] - 1 [illegible] [illegible] from [illegible] figures for the yield stress [illegible] 5 kg/mm² for [illegible] and [illegible] 6 [illegible]/mm² for [illegible] studied in the annealed condition [illegible] the three [illegible] and a rate of [illegible] mens; this [illegible] than the cold-work[illegible] cold-working [illegible] elevated te[illegible] at room temperature. In the [illegible] the beneficial ef[illegible] high-temperature [illegible] on [illegible] difference [illegible] observed in [illegible] observed in [illegible] higher than [illegible] the effect [illegible] the hypothesis that crystal-lattice defects. Finally, the product [illegible] specimens [illegible] that of annealed materials, this difference increases with increasing degree of preliminary cold plastic deformation. There are [illegible] figures.

Card 2/3

S/126/62/013/003/006/013
E193/E383

On the problem of ....

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A.M. Gor'kogo (Khar'kov State University im. A.M. Gor'kiy)

SUBMITTED: February 28, 1962

Card 3/3

PINES, B.Ya.; KUZNETSOVA, R.I

Change in submicroporosity in electrolytic iron films following annealing under load. Fiz tver. tela 4 no.5:1247-1251 My '62. (MIRA 15:5)

1. Khar'kovskiy gosudarstvennyy universitet imeni Gor'kogo.
(Iron plating) (Diffusion)

PINES, B.Ya.; SIRENKO, A.F.

Diffusion flow and state of nonequilibrium in ceramic metals and metal castings. Izv. vys. ucheb. zav.; chern. met. no.2:81-89 '60. (MIRA 15:5)

1. Khar'kovskiy gosudarstvennyy universitet.
(Diffusion)

PINES, B.Ya.; SIRENKO, A.F.

Determination of dispersity and lattice distortions by harmonic analysis of X-ray diffraction lines. Kristallografiia 7 no.1:20-30 Ja-F '62. (MIRA 15:2)

1. Khar'kovskiy gosudarstvennyy universitet im. A.M. Gor'kogo.

(X-ray crystallography)

PINES, B.Ya.; SIRENKO, A.F.

Determining the dispersity and lattice distortions in U-10 steel following quenching and tempering. Kristallografiia 7 no.1:123-127 Ja-F '62. (MIRA 15:2)

1. Khar'kovskiy gosudarstvennyy universitet.
(Steel—Heat treatment)
(Crystal lattices)

PINES, B.Ya.

Diffusion and mechanical properties of solids. Usp.fiz.nauk 76 no.3:519-556 Mr '62. (MIRA 15:4)
(Solids) (Diffusion) (Viscosity)

PHASE I BOOK EXPLOITATION SOV/5953

Pines, Boris Yakovlevich

Ocherki po metallofizike (Essays in Metal Physics) Khar'kov, Izd-vo Khar'kovskogo gos. univ., 1961. 314 p. 5000 copies printed.

Resp. Ed.: I. V. Smushkov, Candidate of Physics and Mathematics; Ed.: A. N. Tret'yakova; Tech. Ed.: G. P. Aleksandrova.

PURPOSE: This book is intended for scientific research workers and engineers working in the field of metal physics and physical metallurgy. It may also be useful to senior students specializing in metal physics at schools of higher education.

COVERAGE: The book deals with the molecular and kinetic characteristics of metals and alloys. The following are examined: 1) approximate calculations of equilibrium diagrams of metal alloys for two-, three-, and n-component systems, the comparison of calculated and experimental diagrams, and the comparison of alloy constants taken from diagrams with experimental thermal constants;

Card 1/

Essays in Metal Physics (Cont.) SOV/5953

2) the evaluation of surface tension of metals and alloys, including interphase surface tension, with adsorption effects taken into account; 3) various phenomena connected with the manifestations of self-diffusion of metals and alloys, such as sinter[illegible], recrystallization, diffusion creep, and delayed fracture; 4) the phenomena of diffusion in alloys and their effects (the Frenkel and Kirkendall effects, the effect of crystal-lattice distortion on diffusion, etc.). The book is based to a considerable extent on results of investigations carried out by the author in cooperation with A. I. Bublik, Ya. Ye. Geguzin, A. F. Sirenko, I. V. Smushkov, and E. F. Chaykovskiy, all of whom are faculty members at Khar'kov University. There are 134 references, mostly Soviet.

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Card 2/[illegible]

AUTHORS: [illegible], B. Ya., and Ivanov, [illegible]

TITLE: Mechanical properties of copper - [illegible] temperatures

PERIODICAL: Fizika [illegible], v. [illegible]

ABSTRACT: [illegible] that copper - nickel alloys [illegible] 400 to [illegible] g/mm² increases with the nickel concentration [illegible] Ni), at first rapidly and then more slowly. [illegible] peak. Perhaps the mechanism of deformation and fracture [illegible] tions is different. With increasing temperature the curves [illegible] concentration dependence of logτ and logV shift almost parallel [illegible] values of logτ(V). The concentration dependence of [illegible] rate of creep) is almost a mirror image of the concentration [illegible] of logτ. The concentration dependence of V and τ is [illegible] the concentration dependence of the self-diffusion coefficient D. If the nickel concentration increases from 0 to [illegible]% then log(V/D) decreases slightly and log(τD) increases slightly. At ~[illegible]% Ni, log(V/D) [illegible]

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Mechanical properties of ...

rather flat minimum and $\ln(\tau)$ has a rather flat maximum. In the approximation $\ln(V\tau)$ is independent of the temperature, the ... applied, and the nickel ... $n \sim 4.3$ but $\tau \sim (kT)^{3/2} e^{(U_0 - \gamma\sigma)/kT}$. If the ... protected from evaporation then τ is smaller ... changes become clearly apparent at temperatures ... distinct at 1050°C; they are more distinct ... in alloys poor in nickel. There are 5 ...

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet ... (Khar'kov State University ...

SUBMITTED: March 10, 1961

Card 2/2

S/181/62/004/007/020/037
B102/B104

AUTHORS: Fines, B. Ya., Ivanov, [illegible], and Smushkov, I. V.

TITLE: The partial diffusion coefficients and the self-diffusion coefficients of alloys of the copper-nickel system

PERIODICAL: Fizika tverdogo tela, v. 4, no. 7, 1962, [illegible]

TEXT: The values of the experimentally determined heterodiffusion [illegible] coefficients (Fines, Smushkov, FTT, 1, 6, 939, 1959) and the [illegible] ratios of the partial diffusion coefficients are used to determine the partial diffusion coefficients of Ni and Cu in dependence on the concentration of the components at 1000, 900, 800, and 700°C. $D^{sd}_{al} = c_A D_A + c_B D_B$ and $D^{hd}_{al} = c_B D_A + c_A D_B$. D^{sd}_{al} and D^{hd}_{al} are the self- and heterodiffusion coefficients of the alloy, $c_{A,B}$ and $D_{A,B}$ are the atomic concentrations and the partial diffusion coefficients of the components. The partial diffusion coefficients obtained are used to calculate the self-diffusion coefficients of Cu-Ni alloys as dependent on the concentration. The calculations are

Card 1/3

The ... diffusion coefficient...

... approximation (Pines, ...), where ... is the vacancy concentration in the alloy of ... concentration, ... a thermodynamic factor

... is the ... energy, z the coordination number in the alloy ... the interatomic distance, ... the shortest lattice vibration ... the change in potential energy of the alloy when an A atom is ... "to infinity", ... is the same when the atom is brought from infinity to the "potential barrier vertex". An atom located at this vertex ... the coordination number ... so that ... = −(z−z′) ... are the mutual potential energies. ... = exp(−ΔF ... /2kT), ΔF ... is the change in free energy,

$$\Delta F_0 = -(z - z')[(1 - c_B)^2 U_{AA} + c_B^2 U_{BB} + 2c_B(1 - c_B) U_{AB}]. \quad (5a)$$

Card 2/...

[illegible] coordination number [illegible] atom situated between two lattice nodes. The self-diffusion coefficients are obtained from

$$
\left.
\begin{aligned}
D_{Cu}^{Cu} &= M \exp \frac{1}{kT}\left[\frac{\varepsilon-\varepsilon''}{2}+z-z'\right]U_{CuCu};\\
D_{Cu}^{Ni} &= M \exp \frac{1}{kT}\left[\frac{\varepsilon-\varepsilon''}{2}U_{NiNi}+(z-z')\right]U_{CuNi};\\
D_{Ni}^{Cu} &= M \exp \frac{1}{kT}\left[\frac{\varepsilon-\varepsilon''}{2}U_{CuCu}+(z-z')\right]U_{CuNi};\\
D_{Ni}^{Ni} &= M \exp \frac{1}{kT}\left[\frac{\varepsilon-\varepsilon''}{2}+z-z'\right]U_{NiNi},
\end{aligned}
\right\} \quad (9)
$$

$$
\left.
\begin{aligned}
\mu &= \frac{D_{Ni}^{Cu}}{D_{Cu}^{Ni}} = \exp \frac{\varepsilon-\varepsilon''}{\varepsilon}\,\frac{1}{kT}\,(q'_{Ni}-q'_{Cu});\\
\nu &= \frac{D_{Cu}^{Cu}}{D_{Ni}^{Ni}} = \exp \frac{1}{kT}\,\frac{\varepsilon-\varepsilon''+2(\varepsilon-\varepsilon')}{\varepsilon}\,(q'_{Ni}-q'_{Cu});\\
\frac{\nu}{\mu} &= \exp \frac{2(\varepsilon-\varepsilon')}{\varepsilon}\,\frac{1}{kT}\,(q'_{Ni}-q'_{Cu}).
\end{aligned}
\right\} \quad (9a)
$$

The partial diffusion coefficients...

Here $q'_{Ni}-q'_{Cu}$ is the difference of the latent evaporation heats per atom. $N(q'_{Ni}-q'_{Cu}) = q_{Ni}-q_{Cu} = 15-16$ kcal/g-at, $(z-z'')/2 = 2.58$, $z-z' = 1.42$. $\Sigma U_0 = 2.6 \cdot 10^{-13}$ erg/part. There are 4 figures.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A. M. Gor'kogo (Khar'kov State University imeni A. M. Gor'kiy)

SUBMITTED: February 22, 1962

Fig. 3. Self-diffusion coefficients as dependent on the Ni concentration at%. 1, 1', 1'', 1''' - experimental curves, 2, 2', 2'', 2''' calculated (equilibrium) curves.

Fig. 4. Experimental (1 and 3) and calculated (2 and 4) equilibrium partial diffusion coefficients (D^{al}_{Cu} and D^{al}_{Ni}) as dependent on the Ni concentration.

S/181/62/004/007/023/037
B102/B104

AUTHOR: Pines, B. Ya., and Sirenko, ... F.

TITLE: Concentration dependence of creep rate and longevity under load of metal alloys of the systems iron - carbon and iron - copper at elevated temperatures

PERIODICAL: Fizika tverdogo tela, v. 4, no. 7, 1962, [illegible]

TEXT: The concentration dependences of the mechanical properties of Fe - C alloys were studied in cast and powder-metallurgical specimens. The former contained < 0.02 (Armco), 0.06, 0.26 and 1% of C with impurities according to ГОСТ(380-50)(GOST(380-50)) for the types of steel Ст.1 (St.1), Ст.5 (St.5) and У-10 (U-10); the latter contained 0.05, 0.1, 0.3, 0.5 and 0.8% of C. All specimens were 50 mm long and had a cross section of 2.5·2.5 mm^2. The measurements were made at 700-1100°C. The Fe-Cu specimens (same size) were pressed from Armco-iron powder and electrolytic Cu (grain size < 50 μ) in eight different concentrations. After sintering at high temperatures the

Card 1/3

Concentration dependence of creep ... S/181/62/004/007/024/037
B102/B104

Measurements were carried out under stresses of 1300-2500 g/mm^2 at 800, 900 and 1000°C. Results: In Fe-C alloys the creep rate is proportional to the self-diffusion coefficient at all temperatures and concentrations. The same tendency was observed at Fe - Cu. In Fe - Cu alloys the concentration dependence of the creep rate is a non-linear function at all temperatures; it is always lower than would be implied by a linear law. This fact is attributed to a boundary effect of the different types of grains. The creep rate V is a power function of the stress $V \sim p^n$. For Fe-C n = 4.0, for Fe-Cu n = 4.3-4.5. As regards stresses which are not too small, this is in agreement with experimental data. In first approximation log $V\tau$ is independent of stress and temperature (τ - longevity under stress) but depends on the structural state and concentration of the alloy. It differs greatly for cast and powder-metallurgical specimens of the same concentration and depends greatly on the heat treatment. For Fe - Cu alloys, log $V\tau$ varies most strongly in the single-phased regions and weakly in the two-phased regions of the equilibrium diagram. The approximate constancy of log $V\tau$ is not inconsistent with the relation $V \sim Dp^n$ and that obtained for τ by Pines

Card 2/3

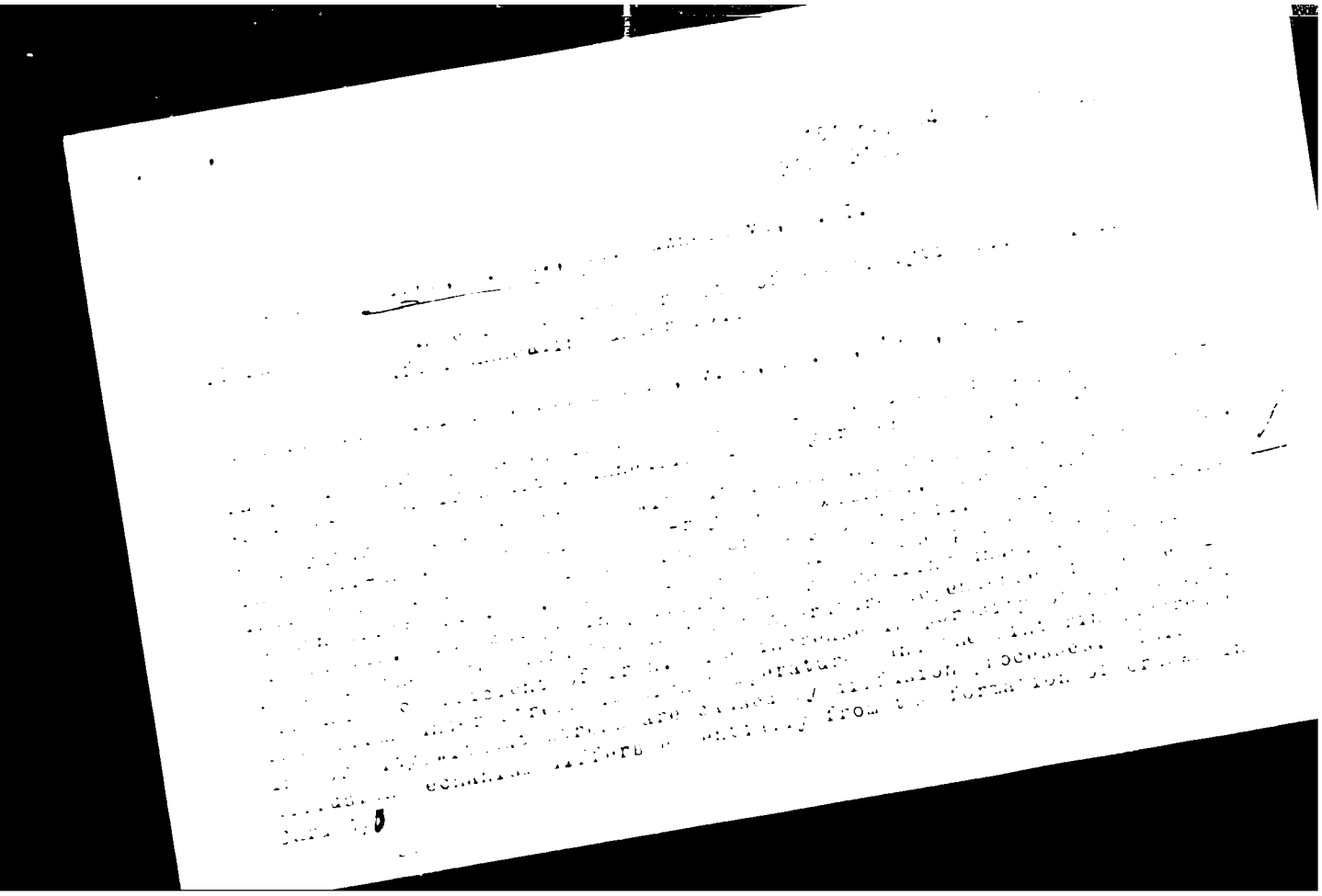
Concentration dependence of creep ... S/181/62/004/007/023/037
B102/B104

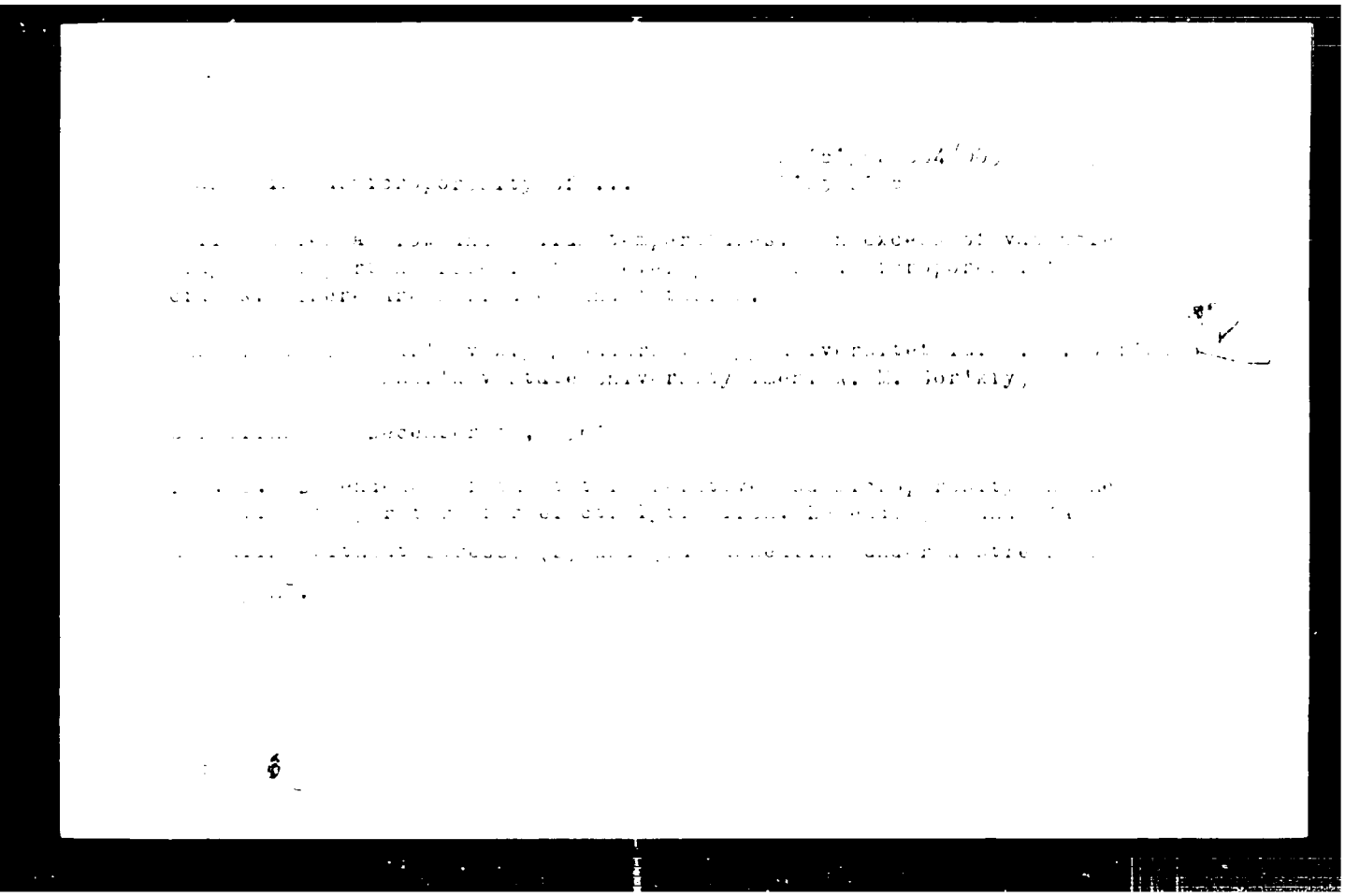
(FTT, 4, 2, 265, 1958). There are 11 figures.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A. M. Gor'kogo (Khar'kov State University imeni A. M. Gor'kiy)

SUBMITTED: March 1, 1962

Card 3/3





PINES, B.Ya.

Kinetics of sintering in the solid phase. Fiz. met. i metalloved. 16 no.4:557-566 O '63. (MIRA 16:12)

1. Khar'kovskiy gosudarstvennyy universitet imeni Gor'kogo.

PINES, B.Ya.; GREBENNIK, I.P.

High-temperature electron diffraction apparatus with three magnetic lenses and an evaporative chamber. Prib. i tekh. eksp. 6 no.1: 156-160 Ja-F '61. (MIRA 14:9)

1. Khar'kovskiy gosudarstvennyy universitet.
(Electron diffraction apparatus)

S/053/62/076/003/004/005
B125/B102

AUTHOR: Pines, B. Ya.

TITLE: Diffusion and mechanical properties of solids

PERIODICAL: Uspekhi fizicheskikh nauk, v. 76, no. 3, 1962, 513-536

TEXT: On the basis of papers published from 1941 to 1961 a review has been compiled on the diffusion and the mechanical properties of solids. There are 17 figures and 100 references: 47 Soviet and 53 non-Soviet.

Card 1/1

PINES, B.Ya.; SIVOCHUB, V.A.

Structural changes in copper single crystals in high-temperature creep. Fiz. tver. tela 3 no.9:2703-2711 S '61. (MIRA 14:9)

1. Khar'kovskiy gosudarstvennyy universitet imeni A.M. Gor'kogo.
(Copper crystals) (Creep of metals)

24.7200 (1153)

S/070/62/007/001/007/022
E132/E460

AUTHORS Pines, B.Yu., Sirenko, A.F.

TITLE The determination of the dispersion and distortion of a lattice by means of the harmonic analysis of the forms of the X-ray powder lines

PERIODICAL Kristallografiya v 7 no 1 1962 20-30

TEXT An examination is made of the errors arising in the Fourier analysis of the form of lines in an X-ray powder photograph because of the inexact separation of the line from the background. It is shown that errors of this kind lead to a parallel displacement of the ordinates of the Fourier transform in the semi-logarithmic plot of $z = -\log A_n$ against n, where A_n is the nth order Fourier coefficient. It is shown that the errors conditioned by the differences between the calculated Fourier coefficients reckoned over an infinite interval and the coefficients corresponding to a finite interval of subdivision for the case of the Cauchy curve also produce a parallel displacement of the ordinates of the curve $z = -\log A - z(n)$. A calculated verification carried out from synthetic curves of the Cauchy type

Card 1/2

S/070/62/007/001/003/0[illegible]
E132/E460

The determination of

of the Gaussian type and of mixed type showed that the departure of the experimentally constructed curve of γ log λ_n $\gamma(n)$ from the calculated one always leads to a parallel displacement of the ordinates of the curve On this basis a general method of analysing an interference line appears to be the construction of the Fourier transform and the approximation by the function γ γ_0 + Mn - Nn^2 to the values found for γ log λ_n The coefficients M and N can be found from the experimental values of γ for all integral values of n except n 0 There are 4 figures and 1 table

ASSOCIATION Kharkovskiy gosudarstvennyy universitet im A M Gor'kogo (Khar'kov State University imeni A M Gor'kiy)

SUBMITTED February 17 1961

Card 2/2

PINES, B.Ya.; CHAYKOVSKIY, E.F.

Does diffusion in metals accelerate or retard plastic deformation? Fiz. met. i metalloved. 11 no. 5:812-841 My '61. (MIRA 14:5)

1. Khar'kovskiy gosudarstvennyy universitet imeni A.M. Gor'kogo. (Metallography) (Deformations (Mechanics))

PINES, Boris Yakovlevich; SHUSHKOV, I.V., kand. fiz.-mat. nauk, otv. red.; TRET'YAKOVA, A.N., red.; ALEKSANDROVA, G.P., tekhn. red.

[Physical metallurgy] Ocherki po metallofizike. Khar'kov, Izd-vo Khar'kovskogo gos.univ. im. A.M.Gor'kogo, 1961. 314 p. (MIRA 14:12)

(Physical metallurgy)

PINES, B.Ya.; KUZNETSOVA, R.I.

Variation of submicroporosity in electrolytic metallic films during heating and under load. Fiz.tver.tela 3 no.5:1475-1484 My '61. (MIRA 14:6)

1. Khar'kovskiy gosudarstvennyy universitet imeni A.M.Gor'kogo.
(Porosity) (Electrochemical analysis)

24 7700 1043 1559 1137

15 2440

3172

S/070/61/006/006/003/008
E132/E135

AUTHORS: Pines, B.Ya., and Gumen, N.M.

TITLE: An X-ray study of cobalt ferrite which has undergone thermomagnetic treatment

PERIODICAL: Kristallografiya, v. 6, no. 6, 1961, 901-908 + 1 plate

TEXT: It is shown that $CoFe_2O_4$ of strictly stoichiometric composition does not show magnetostrictive or structural changes after annealing in a magnetic field (TMO). The conditions used were annealing in N_2 at 300 °C for 3 hours in a field of 7000 Oe followed by cooling under the same conditions at 300 °C/hour. In the oxidised state (0.5% extra combined oxygen) cobalt ferrite showed an increased value of the magnetostrictive saturation and a lowered lattice constant (by comparison with the composition $CoFe_2O_4$). After TMO the ferrite had developed a uniaxial magnetic texture directly connected with the presence of excess oxygen. In this state the coefficient of magnetostrictive saturation λ_s which depends on angle according to

$$\lambda_s = a_1/3 + a_2 \sin^2 \theta + (a_1 - a_2) S$$

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An X ray study of cobalt ferrite . . S/070/61/006/006/007/009
E132/E135

where: a_1 $3/2\lambda_{[100]}$ a_2 $3/2\lambda_{[111]}$ θ is the Bragg ang-
and
S $\sum a_i^2 \beta_i^2$ where α_i and β_i are the direction
cosines of the magnetisation vector and the direction of measure-
ment of λ_θ relative to the cube axes. It can be calculated
that the deformation of the lattice after TMO consists not only
in a change of dimensions and shape of the unit cell but comprises
also a change in the positions of the ions Co and Fe relative to
the O ions. This requires verification by measuring X ray
reflexion intensities in single crystals before and after TMO.
There are 4 figures and 14 references 4 Soviet-bloc and 10 non-
Soviet bloc. The four most recent English language referen-
Ref.7: R F Penoyer, L.R Bickford, Phys Rev. Vol.108 -
271-277 1957 L R Bickford J.M Brownlow
R F Penoyer J. Appl.Phys., Vol. [illegible]
Ref.8: S Iida J. Appl. Phys. Vol.32 5 479-486 1960
Ref.9: H.J. Williams, R D. Heidenreich, E A. Nesb
J. Appl. Phys. Vol.27 1, 85-89 1956.

Card 2/3

W272

An X-ray study of cobalt ferrite ... S/070/61/006/006/003/008
E132/E135

Ref. 1: K.M. Merz J. Appl. Phys. Vol. 31 1 147 1960

ASSOCIATION Khar'kovskiy gosudarstvennyy universitet im A.M. Gor'kogo
(Khar'kov State University imeni A.M. Gor'kiy)

SUBMITTED June 6 1961

Card 3/3

PINES, B. Ya.

Directional self-diffusion in solids under the effect of temperature gradients. Fiz. met. i metallov. 11 no.6:948-951 Je '61. (MIRA 14:6)

1. Khar'kovskiy gosudarstvennyy universitet imeni A. M.Gor'kogo.
(Diffusion)
(Metals, Effect of temperature on)

FINES, B.Ya.; SMUSHKOV, I.V.

Coefficients of self-diffusion in alloys. Fiz. tver. tela 3 no.1:146-153 Ja '61. (MIRA 14:3)

1. Khar'kovskiy gosudarstvennyy universitet im.A.M.Gor'kogo. (Diffusion) (Alloys)

PHASE I BOOK EXPLOITATION SOV/5505

Moscow. Institut stali

Relaksatsionnyye yavleniya v metallakh i splavakh, trudy Mezhvuzovskogo soveshchaniya (Relaxation Phenomena in Metals and Alloys; Transactions of the Inter-Institute Conference) Moscow, Metallurgizdat, 1960. 326 p.

Sponsoring Agency: Ministerstvo vysshego i srednego spetsial'nogo obrazovaniya RSFSR and Moskovskiy institut stali imeni I.V. Stalina.

Ed. (Title page): B.N. Finkel'shteyn; Ed. of Publishing House Ye.I. Levit; Tech. Ed.: A.I. Karasev.

PURPOSE: This collection of articles is intended for personnel in scientific institutions and schools of higher education and for physical metallurgists and physicists specializing in metals. It may also be useful to students of these fields.

COVERAGE: The collection contains results of experimental and theoretical investigations carried out by schools of higher education and scientific research institutions in the field of the relaxation phenomena in metals and alloys. Several articles are devoted to the investigation—by the internal-friction method—of the decomposition of supersaturated solid solutions. Also analyzed are the defects of the crystalline lattice, plastic deformations, high-temperature behavior of alloys, and creep. Problems of the relation between internal friction and temper brittleness, the use of the method of internal friction in the investigation of powder-metallurgy products, and the mechanism of impact fatigue are discussed. The collection also contains articles on the damping characteristics of materials, elastic after-effect, and the new slow-detection method. No personalities are mentioned. References follow most articles. There are 366 references: 192 Soviet and 174 non-Soviet.

Relaxation Phenomena in Metals (Cont.) SOV/5505

[illegible], B.Ya., and Den Ge-Sen [Khar'kovskiy gosudarstvennyy universitet (Khar'kov State University)]. Analysis of the Internal Friction of Powder-Metallurgy Products 295

Mišek, Karel [Institute of Technical Physics of the Czechoslovak Academy of Sciences]. Magnetomechanical Phenomena in the Alternating Magnetic Field as a Relaxation Process 305

Beliaskiy, Yu.P. [Tsentral'nyy nauchno-issledovatel'skiy institut chernoy metallurgii (Central Scientific Research Institute of Ferrous Metallurgy)]. Magnetostriction, Modulus of Elasticity, and Internal Friction of Certain Iron-Base Ferromagnetic Solid Solutions 311

Savrotskiy, I.V., Yu.S. Tomenko, V.M. Golik, and V.A. D[illegible] [Ukrainskiy nauchno-issledovatel'skiy institut metallov (Ukrainian Scientific Research Institute of Metals)]. Study of the Impact-Fatigue Mechanism by the Damping Method of Measuring 316

AVAILABLE: Library of Congress

VK/wrc/gmp
7-28-61

Card 8/8

PINES, B.Ya.

Kinetics of sintering in the solid phase. Fiz. met. i metalloved. 10 no.5:750-755 N '60. (MIRA 14:1)

1. Khar'kovskiy gosudarstvennyy universitet imeni A.M. Gor'kogo.
(Sintering)

S/126/61/011/001/003/019
E111/E452

AUTHORS: Pines, B.Ya. and Chaykovskiy, E.F.

TITLE: Investigation of the Kinetics of the Recrystallization of Cold-Deformed Iron

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol.11, No.1, pp.34-39

TEXT: The authors, with Kaluzhinova (Ref.1), have shown that in the initial stage of low-temperature annealing of copper very rapid block growth occurs, explicable on the basis of a dislocation mechanism (polygonization); further block growth after high temperature annealing is due to diffusional collective recrystallization. The object of the present work was to see whether similar effects occur in other metals, particularly Armco iron. Zh.V.Skuratovskaya, G.V.Ptitsyn and V.G.Krivko participated in the work, which was carried out as before (Ref.1). In the first part the relation between linear block size (e.g. L,μ) and the degree of plastic deformation (ε,%) was found. This is shown in Fig.1 for deformations up to about 70%. In the next stage, block growth kinetics in isothermal annealing at 600 to 1000°C of specimens plastically deformed approximately to 50% were studied.

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S/126/61/011/001/003/019
E111/E452

Investigation of the Kinetics of the Recrystallization of Cold-Deformed Iron

Before X-ray examination, specimens were etched with 5% alcoholic nitric acid. 200-micron diameter capillaries were used for specimens annealed up to 890°C and larger diameters (up to 560 microns) for higher temperatures. The work showed that specimens 50% deformed and having an initial block size of about 0.4 microns showed, after annealing at 600, 700, 800 or 890°C for periods of 5 seconds to 20 hours, effects similar to those found for copper (Ref.1); in the initial stages, blocks of about 4 microns are rapidly formed. The activation energy for this rapid block growth is estimated at 41000 cal/g atom. As with copper, further block growth or prolonged high-temperature annealing is diffusional in character. Fig.2 shows dependence of block dimension (L,μ) on isothermal annealing time (Vt, hrs); the graphs 1, 2 and 3 relate to the annealing temperatures 890, 950 and 1000°C respectively. Activation energies for this process are 51 kcal/g.at at 700, 800 and 890°C and 68.4 at 950 and 1000°C. Changes in secondary extinction accompanying the diffusional growth were measured as previously (Ref.1) with a type УРС-50И (URS-50I)

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Investigation of the Kinetics of the Recrystallization of Cold-Deformed Iron

apparatus. Fig.3 shows changes in integral intensity I for (110) and (220) lines with respect to block size (L,μ) at 700, 800 and 890°C (curves 1, 2 and 3 respectively). Block size was found by the micro-beam method; the authors discuss the inherent errors. Fig.4 shows relative errors as functions of block size (L,μ) for two sizes of capillary used in the determination and for two different absolute errors (Curve 1, $\Delta N = 3$, capillary 200 μ; Curve 2, $\Delta N = 1$, capillary 200 μ; Curve 3, $\Delta N = 3$, capillary 56 μ; Curve 4, $\Delta N = 1$, capillary 560 μ). As the dimension rises from 3 to 5.5 microns, the error rises tenfold. There are 4 figures, 1 table and 7 references: 5 Soviet and 2 non-Soviet.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A.M.Gor'kogo (Khar'kov State University imeni A.M.Gor'kiy)

SUBMITTED: May 26, 1960

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S/126/61/011/001/003/019
E111/E452

Investigation of the Kinetics of the Recrystallization of Cold-Deformed Iron

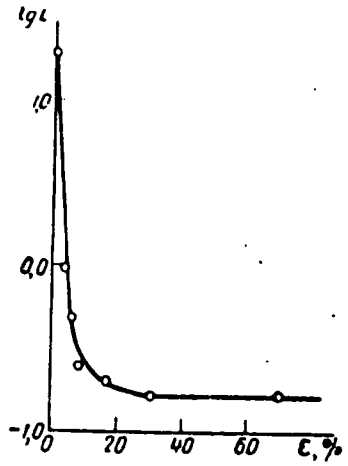

Fig.1.

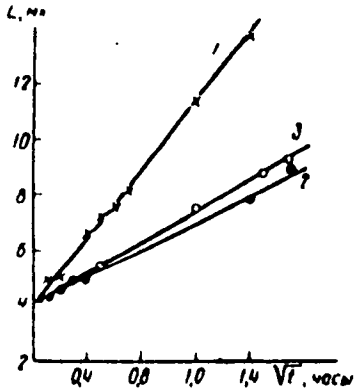

Fig.2.

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S/126/61/011/001/003/019
E111/E452

Investigation of the Kinetics of the Recrystallization of Cold-Deformed Iron

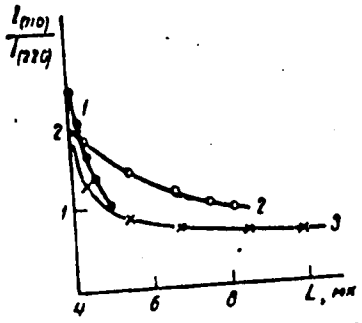

Рис. 3. Изменение интегральной интенсивности I линий (110) и (220) в зависимости от размера блока для различных температур отжига:
1 — 700°, 2 — 800°, 3 — 890°

Fig.3.

Рис. 4. Изменение относительной погрешности $\frac{\Delta V}{V}$ в зависимости от заданных размеров L блока при различных значениях величины A (освещаемой поверхности образца) и абсолютной погрешности числа пятен ΔN:
1 — $\Delta N = 3$, капилляр 300 мк; 2 — $\Delta N = 1$, капилляр 200 мк; 3 — $\Delta N = 3$, капилляр 560 мк; 4 — $\Delta N = 1$, капилляр 560 мк

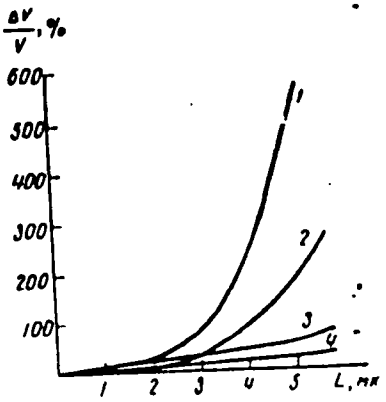

Fig.4.

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S/181/61/003/001/017/042
B006/B056

AUTHORS: Pines, B. Ya. and Smushkov, I. V.

TITLE: Self-diffusion coefficients in alloys

PERIODICAL: Fizika tverdogo tela, v. 3, no. 1, 1961, 146-153

TEXT: The present paper deals with a theoretical estimation of the self-diffusion coefficient D_i^{sd} of the i-th component of an alloy. The studies are based upon the following equations of the diffusion theory: For the flux of the i-th component, $q_i = -D_i \partial c_i/\partial x$ holds, where c_i denotes the concentration and D_i the diffusion coefficient of the component; D_i is a partial diffusion coefficient. The "mean" heterodiffusion coefficient of a binary alloy is given by $D = c_1 D_2 + c_2 D_1$. D_i is related to D_i^{sd}, which is also described as being a partial self-diffusion coefficient, by the relation (3): $D_i = D_i^{sd}(1+\partial \ln f_i/\partial \ln c_i)$, where f_i is the activity

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Self-diffusion coefficients in alloys

coefficient of the i-th component. If the solid solution is regular, $D_i = D_i^{sd}\left[1 - \frac{2U_o}{kT}c(1-c)\right]$ holds, where U_o is the mixing energy of the alloy. For describing the heterodiffusion, it is therefore necessary to know D_i^{sd}. The estimation of D_i^{sd} is carried out for various simple cases. First, a binary alloy of inhomogeneous concentration distribution is studied; A is assumed to contain a radioactive isotope of the concentration $c_1(x)$; the non-radioactive isotopes of the component A have the concentration $c_2(x)$; the component B has the concentration (1-c), where $c = c_1+c_2$. For the volume flux of the radioactive atoms one obtains: $\Delta Q = -\delta^2(\alpha\frac{dc_1}{dx} + c_1\frac{d\alpha}{dx})$ or $\Delta Q = -\delta^2(\alpha - c_1\frac{d\alpha}{dc_1})\frac{dc_1}{dx}$, where δ is the interatomic distance, and α is the concentration-dependent transition probability of a radioactive atom from one plane to another (at the distance δ). The cases are now investigated, in which $c_1(x)$ and $c_2(x)$ are variable, but $c = c_1 + c_2$ is constant. The following is obtained: $\Delta Q = -\delta^2\alpha\frac{dc_1}{dx}$, where

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S/181/61/003/001/017/042
B006/B056

Self-diffusion coefficients in alloys

$D_A^{sd}(c) = -\int^2_d$ is the "radioisotopic" self-diffusion coefficient. If also $c=c(x)$, then $\Delta Q = -\left[D_A^{sd}(c) + c_1 \frac{dD_A^{sd}}{dc}\frac{dc}{dc_1}\right]\frac{dc_1}{dx}$. If $c_2 \simeq 0$ and $c_1 \simeq c$, then

$\Delta Q \simeq -\left[D_A^{sd}(c) + c\frac{dD_A^{sd}}{dc}\right]\frac{dc}{dx}$. If $c_2=0$ and $c_1=c$, the partial heterodiffusion coefficient is defined by $D_A^{hd}(c) = D_A^{sd}(c) + c\frac{I_A^{sd}(c)}{dc}$ (11). From (11) and (3) one obtains $D_A^{sd}(c) = D_A^{sd}(1)f(c)$, where $D_A^{sd}(1)$ is the self-diffusion coefficient in pure metal. If the interatomic distance is a function of concentration, $D_A^{sd}(c) = \frac{\delta^2(1)}{\delta^2(c)} D_A^{sd}(1)f(c)$, where $\delta(1)$ is the interatomic distance in the pure metal A. In a regular solid solution, the activity coefficient $f(c) = \exp\frac{U_o}{kT}(1-c)^2$, and one obtains

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Self-diffusion coefficients in alloys

$D_A^{sd}(c_A) = D_{oA}\exp\left[-\frac{Q_A - U_o(1-c_A)^2}{kT}\right]$, where Q_A is the activation energy of self-diffusion in pure metal. Aproximatively, $D_o^{sd} \simeq \delta^2\nu\exp(\Delta s/k)$, where ν is the frequency of atomic vibrations, and Δs is the entropy of self-diffusion activation, $D_o = D_{oA}$. For diffusion in infinite dilution ($c_A = 0$), $Q_A(0) = Q_A(1) - U_o$ holds. If by $D^{sd} = c_1 D_1 + c_2 D_2$ one denotes the coefficient of self-diffusion of "averaged" alloy atoms, one obtains the following relation in the approximation of the regular solution:

$$D^{sd} = c_A D_A^{sd}(1)\exp\left[\frac{U_o}{kT}(1-c_A)^2\right] + c_B D_B^{sd}(1)\exp\left[\frac{U_o}{kT}(1-c_B)^2\right];$$

and for the activation energy of self-diffusion of the alloy it follows that

$$Q_{alloy}^{sd} = -\frac{\partial \ln D^{sd}}{\partial\left(\frac{1}{kT}\right)} = \frac{c_A D_{oA}\left[Q_A - U_o(1-c_A)^2\right]\exp\left[\frac{Q_A - U_o(1-c_A)^2}{kT}\right]}{D^{sd}} + \frac{c_B D_{oB}\left[Q_B - U_o(1-c_B)^2\right]\exp\left[-\frac{Q_B - U_o(1-c_B)^2}{kT}\right]}{D^{sd}}.$$

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S/181/61/003/001/017/042
B006/B056

Self-diffusion coefficients in alloys

Q as a function of Al concentration for an Ag-Al alloy is calculated from the last-mentioned formula, and is compared with experimental data. Agreement, especially for small concentrations, is good. There are 1 figure and 10 references: 8 Soviet-bloc and 2 non-Soviet-bloc.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A. M. Gor'kogo (Khar'kov State University imeni A. M. Gor'kiy)

SUBMITTED: May 27, 1960

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S/126/60/010/006/014/022
E193/E483

AUTHORS: Pines, B.Ya., Grebennik I.P and Smushkov I.V

TITLE: Electron and X-Ray Diffraction Studies of the Heterodiffusion Coefficients in the Nickel-Chromium System

PERIODICAL: Fizika metallov i metallovedeniye 1960 Vol 10, No 6 pp.879-885

TEXT: In the first stage of the present investigation the heterodiffusion in the Ni-Cr system was studied with the aid of a high-temperature electron diffraction camera The experimental specimens were prepared by vacuum deposition, an NaCl substrate having been used to deposit consecutive layers of quartz, nickel chromium and quartz. (The layers of quartz served to prevent preferential oxidation of chromium during the diffusion annealing) The total thickness of the Cr-Ni layer was 1.7×10^{-6} cm. chromium having been deposited in such a quantity that on the completion of the diffusion annealing an alloy, containing 20 to 25 at.% Cr was formed. Two variants of the specimens were made
(1) "equilibrium" nickel - "equilibrium" chromium and
(2) "equilibrium" nickel - "non-equilibrium" chromium The variant

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E193/E483

Electron and X-Ray Diffraction Studies of the Heterodiffusion Coefficients in the Nickel-Chromium System

(1) specimens were prepared by rapid deposition of nickel from strongly super-heated source on to a substrate pre-heated to about 400°C, followed by rapid deposition of chromium on to the nickel layer whose temperature was about 300°C To produce the variant (2) specimens, nickel was deposited in the same way as in variant (1) but was allowed to cool to room temperature before the deposition of chromium was carried out. The electron diffraction pattern of the variant (1) specimens consisted of two systems of narrow lines, whereas those obtained for variant (2) specimens had narrow nickel lines and diffuse chromium lines. The mean value of the diffusion coefficient D for the variant (1) specimens varied from 24.1×10^{-15} cm^2/sec at 600°C to 0.415×10^{-15} cm^2/sec at 520°C; in the case of the variant (2) specimens, D varied from 48.2×10^{-15} cm^2/sec at 550°C to 2.41×10^{-15} cm^2/sec at 450°C The activation energy for diffusion and the pre exponential factor calculated from these data were Q = 51500 cal/mol and $D_o = 0.18$ cm^2/sec for the variant (1) specimens, the corresponding

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E193/E483

Electron and X-Ray Diffraction Studies of the Heterodiffusion Coefficients in the Nickel-Chromium System

values for the variant (2) specimens being 34600 cal/mol and 1.6×10^{-5} cm^2/sec. The specimens used for X-ray diffraction analysis consisted of 1.5 mm thick discs of electrolytic nickel (vacuum-annealed at 1400°C) on which a 5 to 6 micron thick layer of chromium had been electrodeposited. The diffusion annealing (at 700, 800 and 900°C) was carried out in a bath of molten boric oxide. The concentration-dependence of D, determined by X-ray diffraction, was similar for all three test temperatures D decreasing with increasing concentration of chromium. At 900°C D decreased from approximately 1×10^{-10} cm^2/sec at 4 at.% Cr to 0.3×10^{-10} cm^2/sec at 33 at.% Cr. The activation energy Q varied between 30 and 40 kcal/mol; the Q versus concentration curve having a maximum of 40 kcal/mol at 18% Cr and a local minimum of 33.5 kcal/mol at 30% Cr. The D_o versus concentration curve also passed through a maximum at about 18% Cr. The graph illustrating the relationship between log D and 1/T and constructed from data obtained by electron diffraction on the

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S/126/60/010/006/014/022
E193/E483

Electron and X-Ray Diffraction Studies of the Heterodiffusion Coefficients in the Nickel-Chromium System

variant (1) specimens and by X-ray diffraction on electrolytic specimens, constituted a single straight line, indicating a close agreement between the results obtained by both methods. The students Yu.Krot, V.Solunskiy and D.Sherman participated in the work. There are 6 figures, 3 tables and 11 references 9 Soviet and 2 non-Soviet (one of which is translated into Russian)

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet imeni A.M.Gor'kogo (Khar'kov State University imeni A.M.Gor'kiy)

SUBMITTED: March 11, 1960

Card 4/4

PINES, B.Ya.; DEN GE SEN

Investigating internal friction in ceramic metals. Part 5. Effect determining plastic deformation at low temperatures. Fiz.met.i metalloved. 10 no.1:58-62 Jl '60. (MIRA 13:8)

1. Khar'kovskiy gosudarstvennyy universitet im. A.M.Gor'kogo. (Metals at low temperature) (Ceramic metals)

85968
S/126/60/010/005/018/030
E193/E483

18 6200 1145

AUTHOR: Pines, B.Ya.

TITLE: On the Kinetics of Sintering in a Solid Phase

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol.10, No.5, pp.750-755

TEXT: A critical analysis is presented of the phenomena which had been investigated by Lifshits and Slezov (Ref.1) and Garber et al (Ref.2). In the former case, the kinetics of decomposition of a super-saturated solid solution was studied, with particular reference to the late stages of the process during which coalescence of the grains takes place. New laws were established regarding the time dependence of the maximum radius of the precipitated "inclusions" and of the degree of super-saturation of solid solutions. The theory postulated by Lifshits and Slezov was applied to elucidate the mechanism of sintering of metal powders and it was shown that this process can be regarded as consisting of two counter-current phenomena: (1) growth of pores ("void crystals") and their coalescence in regions distant from the grain-boundaries, and (2) "dissolution" of pores accompanied by ejection of vacancies

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E193/E483

On the Kinetics of Sintering in a Solid Phase

(from the super-saturated solution), which then diffused to the external boundary of the particle where so-called "sintered skin" is formed. In the latter case, the time-dependence of the process of sintering and coalescence of pores in rock salt was experimentally determined, the results confirming the theoretical predictions made by Lifshits and Slezov. The present author shows that expressions derived by the latter workers are valid only if it is assumed that, parallel to sintering and coalescence, decomposition of the super-saturated solid solution takes place and derives an expression for the time-dependence of the thickness of the sintered skin, which is simpler than that derived by Lifshits and Slezov. He also shows that the mechanism of sintering, discussed by these workers, is not applicable to powders such as are used in powder metallurgy, being valid only for materials which are initially pore-free and which become porous only after heating, during which formation of a super-saturated solution of vacancies takes place followed by ejection of the excess vacancies from the solution. The implications of the

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S/126/60/010/005/018/030
E193/E483

On the Kinetics of Sintering in a Solid Phase

difference between these two processes are discussed in detail and it is suggested that, to avoid confusion, the process associated with the dissolution and precipitation of vacancies should be referred to as "precipitation sintering". There are 8 Soviet references.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A.M.Gor'kogo (Khar'kov State University im. A.M.Gor'kiy)

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